WASHINGTON STATE DEPARTMENT OF ECOLOGY

Dangerous Waste Annual Report Verification Form 1997

Washington State Department of Ecology
Hazardous Waste Information
P. O. Box 47658
Olympia, WA 98504-7658
(800) 874-2022 (within state)
(360) 407-6170

For Ecology Use Only - Date Received: MAR 0 2 1998

Form	Review	Data Entry	Verification
VF			
GM			
WR			
OT			

RCRA Site ID: WAD 001 882 984
Company Name: KAISER ALUMINUM TACOMA WORKS
Site Location: 3400 TAYLOR WY
City/State/Zip: TACOMA, WA 98421 County: PIERCE
Dept. of Revenue Tax Registration Number: 409-004-225 SIC: 3334
Current company name if different from above:

This Report is Due No Later Than March 2, 1998

Please fill in any corrected information on the right hand column.

1a The mailing address for this site is:

Name: Kaiser Aluminum Tacoma Works
Address: 3400 TAYLOR WAY
TACOMA, WA 98421-4308

1b
Name:
Address:

2a The legal company/agency owner of this site is:

Name: Kaiser Aluminum & Chemical Corp
Address: 6177 SUNOL BLVD
PLEASANTON, CA 94566-7769
Phone: (510) 462-1122 Ext:

2b
Name:
Address:
Phone: Ext:

Did the ownership of this site change in 1997?
☐ Yes Date: ☐ No

I represent the ☐ Current Owner ☐ Previous Owner
This report covers waste activity for:
☐ Entire year ☐ My term of ownership only

3a The land owner of this site is:

Name: Kaiser Aluminum & Chemical Corp
Address: 6177 SUNOL BLVD
PLEASANTON, CA 94566-7769
Phone: (510) 462-1122 Ext:

3b
Name:
Address:
Phone: Ext:

4a The contact for site visits and inspections is:

Name/Title: PAUL SCHMEIL
Mail Address: 3400 TAYLOR WAY
TACOMA, WA 98421-4308
Phone: (253) 591-0416 Ext:

4b
Name/Title:
Address:
Phone: Ext:

5a The contact for annual report forms is:

Name/Title: PAUL SCHMEIL
Mail Address: 3400 TAYLOR WAY
TACOMA, WA 98421-4308
Phone: (253) 591-0416 Ext:

5b
Name/Title:
Address:
Phone: Ext:

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GM Form--1997
GENERATION AND MANAGEMENT FORM

GM Form
ANSWER SHEET

EPA/State ID Number: WAD001882984	For Ecology Use Only: Date Received:
Site Name: Kaiser Aluminum-Tacoma Works	

A. Description of Dangerous Waste Stream

A-1. D85343			0001
A-2. Spent Potliner			
A-3. K088			A-4.
A-5. DW	A-6. NO		A-7. A59
A-8. B319	A-9. i (Recurrent)		A-9a. ---

B. Waste Management Activities

B-1. 4,505,560 P			B-1a. ---------		B-2. Off-site	
B-3. ----					B-3a.-	B-3b.-
B-4.	i. Receiving Facility ID	ii. System Code	iii. Quantity	iv. Recycling percent	B-6.	
	ORD089452353	M132	4,505,560	0		

C. Waste Minimization Activities (Complete for odd (e.g. 95, 97) reporting years.)

C-1.	C-2.
C-3.	C-4.

D. Comments:

A-7. A59 per WDOE Publication # 95-424
A-8. Carbon, sodium aluminum fluoride, aluminum oxide, calcium fluoride, metallic aluminum, metgalic and oxides of iron, aluminum carbide, aluminum nitride, sodium oxide, sodium fluoride, silicon dioxide, and free and complexed cyanides.

D.5. Manifest Information

i. Date Shipped	ii. Manifest Document Number	iii. Internal Tracking Code	iv Receiving Facility ID	v. Quantity Shipped
See pages 4-6 for the manifest information.				

GENERATION AND MANAGEMENT FORM ANSWER SHEET

EPA/State ID Number:	WAD001882984
Site Name:	Kaiser Aluminum - Tacoma Works

B-5. (Continued)

i. Date Shipped	ii. Manifest Document Number	iii. Internal Tracking Code	iv. Receiving Facility ID	v. Quantity Shipped
01/02/97	96537		ORD089452353	58,800
01/06/97	96538		ORD089452353	61,320
01/06/97	96539		ORD089452353	57,120
01/22/97	96540		ORD089452353	59,700
01/23/97	96541		ORD089452353	58,400
02/11/97	96542		ORD089452353	58,060
02/18/97	96543		ORD089452353	60,660
02/21/97	97544		ORD089452353	57,940
02/24/97	97545		ORD089452353	60,100
02/27/97	97546		ORD089452353	61,700
03/03/97	97547		ORD089452353	61,020
03/04/97	97548		ORD089452353	58,860
03/05/97	97549		ORD089452353	59,720
03/13/97	97550		ORD089452353	61,500
03/14/97	97551		ORD089452353	61,000
03/20/97	97552		ORD089452353	62,140
03/27/97	97553		ORD089452353	62,020
04/01/97	97554		ORD089452353	59,220
04/04/97	97555		ORD089452353	60,320
04/07/97	97556		ORD089452353	56,820
04/18/97	97557		ORD089452353	60,280
04/24/97	97558		ORD089452353	63,020
04/25/97	97559		ORD089452353	58,500
05/02/97	97560		ORD089452353	60,220
05/08/97	97561		ORD089452353	60,900
05/22/97	97562		ORD089452353	59,920
05/23/97	97563		ORD089452353	55,800
06/03/97	97564		ORD089452353	56,260
06/06/97	97565		ORD089452353	58,020
06/11/97	97566		ORD089452353	58,460
06/18/97	97567		ORD089452353	62,920
06/20/97	97568		ORD089452353	61,780
06/23/97	97569		ORD089452353	53,260
06/26/97	97570		ORD089452353	53,960
06/30/97	97571		ORD089452353	60,220
07/03/97	97572		ORD089452353	59,160
07/07/97	97573		ORD089452353	63,340

GENERATION AND MANAGEMENT FORM ANSWER SHEET

EPA/State ID Number:	WAD001882984
Site Name:	Kaiser Aluminum - Tacoma Works

B-5. (Continued)

i. Date Shipped	ii. Manifest Document Number	iii. Internal Tracking Code	iv. Receiving Facility ID	v. Quantity Shipped
07/17/97	97574		ORD089452353	61,520
07/18/97	97575		ORD089452353	56,100
07/24/97	97576		ORD089452353	54,920
07/30/97	97577		ORD089452353	58,860
08/05/97	97578		ORD089452353	63,880
08/08/97	97579		ORD089452353	57,420
08/15/97	97580		ORD089452353	56,440
08/22/97	97581		ORD089452353	61,340
08/28/97	97582		ORD089452353	59,300
08/29/97	97583		ORD089452353	62,760
09/03/97	97584		ORD089452353	56,340
09/23/97	97585		ORD089452353	62,940
09/25/97	97586		ORD089452353	57,800
09/26/97	97587		ORD089452353	54,560
09/30/97	97588		ORD089452353	60,620
10/01/97	97589		ORD089452353	60,920
10/02/97	97590		ORD089452353	61,380
10/03/97	97591		ORD089452353	57,240
10/06/97	97592		ORD089452353	61,220
10/07/97	97593		ORD089452353	60,220
10/07/97	97594		ORD089452353	50,480
10/16/97	97601		ORD089452353	42,700
10/16/97	97602		ORD089452353	42,940
10/20/97	97603		ORD089452353	46,760
10/21/97	97604		ORD089452353	56,520
10/27/97	97605		ORD089452353	43,540
10/31/97	97607		ORD089452353	47,560
10/31/97	97608		ORD089452353	42,660
10/31/97	97609		ORD089452353	44,080
10/31/97	97610		ORD089452353	46,640
11/11/97	97611		ORD089452353	43,120
11/17/97	97612		ORD089452353	46,440
11/19/97	97613		ORD089452353	47,400
11/19/97	97614		ORD089452353	43,860
11/20/97	97615		ORD089452353	44,980
12/01/97	97616		ORD089452353	41,400
12/01/97	97617		ORD089452353	39,340

1997 GM Form

1997 GM Form Answer Sheet

GENERATION AND MANAGEMENT FORM ANSWER SHEET

EPA/State ID Number:	WAD001882984
Site Name:	Kaiser Aluminum - Tacoma Works

B-5. (Continued)

i. Date Shipped	ii. Manifest Document Number	iii. Internal Tracking Code	iv. Receiving Facility ID	v. Quantity Shipped
12/03/97	97618		ORD089452353	43,200
12/03/97	97619		ORD089452353	48,600
12/17/97	97620		ORD089452353	38,460
12/17/97	97621		ORD089452353	41,980
12/18/97	97622		ORD089452353	44,780
12/18/97	97623		ORD089452353	44,360
12/22/97	97624		ORD089452353	43,160
12/22/97	97625		ORD089452353	42,380
	TOTAL (in Pounds)			4,505,560

GM Form--1997
GENERATION AND MANAGEMENT FORM

GM Form
ANSWER SHEET

EPA/State ID Number: WAD001882984	For Ecology Use Only: Date Received:
Site Name: Kaiser Aluminum-Tacoma Works	

A. Description of Dangerous Waste Stream

A-1. AK9677 0002		
A-2. Air Pollution Dust, Filter Media, Waste Anode/Cathode Paste, Debris with PAHs		
A-3.		A-4. WP03
A-5. EHW	A-6. NO	A-7. A57
A-8. B409	A-9. 1 (Recurrent)	A-9a. ----

B. Waste Management Activities

B-1. 332,680 P			B-1a. ---------		B-2. Off-site	
B-3. --------					B-3a.-	B-3b.-
B-4.	I. Receiving Facility ID	ii. System Code	iii. Quantity	iv. Recycling percent	B-6.	
	ORD089452353	M132	332,680	0.0%		

C. Waste Minimization Activities (Complete for odd (e.g. 95, 97) reporting years.)

C-1.	C-2.
C-3.	C-4.

D. Comments:

A-7. This is a mixed waste stream with source codes of A57, A78, A92, A51. Based upon generator knowledge, A57 was choosen because it probably has the most weight.
A-8. Coal Tar Pitch with PAHs, Coal, coke, alumina, aluminum fluoride, filter media, debris

B-5. Manifest Information

I. Date Shipped	ii. Manifest Document Number	iii. Internal Tracking Code	iv Receiving Facility ID	v. Quantity Shipped
See page 8 for the manifest information.				

1997 GM Form

GENERATION AND MANAGEMENT FORM ANSWER SHEET

EPA/State ID Number:	WAD001882984
Site Name:	Kaiser Aluminum - Tacoma Works

B-5. (Continued)

i. Date Shipped	ii. Manifest Document Number	iii. Internal Tracking Code	iv. Receiving Facility ID	v. Quantity Shipped
01/08/97	96875		ORD089452353	21,200
01/10/97	96876		ORD089452353	7,320
02/03/97	96877		ORD089452353	28,560
02/19/97	96878		ORD089452353	9,220
02/21/97	97879		ORD089452353	20,360
03/26/97	97880		ORD089452353	22,780
04/04/97	97881		ORD089452353	7,500
05/12/97	97882		ORD089452353	24,180
05/13/97	97883		ORD089452353	7,980
06/16/97	97884		ORD089452353	15,120
07/18/97	97885		ORD089452353	14,160
08/14/97	97886		ORD089452353	23,240
08/27/97	97887		ORD089452353	7,040
09/25/97	97888		ORD089452353	17,000
10/20/97	97889		ORD089452353	23,880
10/30/97	97890		ORD089452353	31,200
11/20/97	97891		ORD089452353	29,580
12/04/97	97892		ORD089452353	22,360
			TOTAL	332,680

GM Form--1997
GENERATION AND MANAGEMENT FORM

GM Form
ANSWER SHEET

EPA/State ID Number: WAD001882984	For Ecology Use Only:
Site Name: Kaiser Aluminum-Tacoma Works	Date Received:

A. Description of Dangerous Waste Stream

A-1. 34338 CW3		
A-2. Oil <50 ppm PCB		
A-3. ---		A-4. W001
A-5. DW	A-6. NO	A-7. A57
A-8. B206	A-9. i (Recurrent)	A-9a. ---

B. Waste Management Activities

B-1. 51,858 P	B-1a. ---------	B-2. Off-site	
B-3.		B-3a.	B-3b.

B-4.	i. Receiving Facility ID	ii. System Code	iii. Quantity	iv. Recycling percent	B-6.
	WAD991281767	M061	35,228	0	
	WAD000812909	M061	16,630	0	

C. Waste Minimization Activities (Complete for odd (e.g. 95, 97) reporting years.)

C-1.	C-2.
C-3.	C-4.

D. Comments:

B-5. Manifest Information

i. Date Shipped	ii. Manifest Document Number	iii. Internal Tracking Code	iv Receiving Facility ID	v. Quantity Shipped
07/24/97	26270	Line 11a	WAD991281767	35,228
07/25/97	26271	"	WAD000812909	16,630

GM Form--1997
GENERATION AND MANAGEMENT FORM

GM Form
ANSWER SHEET

EPA/State ID Number: WAD001882984	For Ecology Use Only: Date Received:
Site Name: Kaiser Aluminum-Tacoma Works	

A. Description of Dangerous Waste Stream

A-1. N40001 0004		
A-2. Fluorescent Light Tubes--Crushed, Mercury <260 ppm		
A-3. D009		A-4.
A-5. DW	A-6. NO	A-7. A57
A-8. B319	A-9. i (Recurrent)	A-9a. ---

B. Waste Management Activities

B-1. 550 P			B-1a. ---------		B-2. Off-site	
B-3.					B-3a.-	B-3b.-
B-4.	i. Receiving Facility ID	ii. System Code	iii. Quantity	iv. Recycling percent	B-6.	
	WAD991281767	M111	550	0		

C. Waste Minimization Activities (Complete for odd (e.g. 95, 97) reporting years.)

C-1.	C-2.
C-3.	C-4.

D. Comments

A-8. Glass with mercury < 260 ppm
A-9. All fluorecent tubes at the Tacoma Works were replaced in late 95 and early 96.

B-5. Manifest Information

i. Date Shipped	ii. Manifest Document Number	iii. Internal Tracking Code	iv Receiving Facility ID	v. Quantity Shipped
05/02/97	25393	Line 28a	WAD991281767	300
09/29/97	G416B	Line 11a	"	250

GM Form--1997
GENERATION AND MANAGEMENT FORM

GM Form
ANSWER SHEET

EPA/State ID Number: WAD001882984	For Ecology Use Only: Date Received:
Site Name: Kaiser Aluminum-Tacoma Works	

A. Description of Dangerous Waste Stream		
A-1. 41453 0005		
A-2. Waste Paint and Thinner		
A-3. D001, D006, D007, D008, F003, F005		A-4.
A-5. DW	A-6. NO	A-7. A21
A-8. B209	A-9. 1 (Recurrent)	A-9a.

B. Waste Management Activities						
B-1.			354 P	B-1a. ---------	B-2.	Off-site
B-3.					B-3a.	B-3b.
B-4.	i. Receiving Facility ID	ii. System Code	iii. Quantity	iv. Recycling percent	B-6.	
	WAD991281767	M061	354	0		

C. Waste Minimization Activities (Complete for odd (e.g. 95, 97) reporting years.)	
C-1.	C-2.
C-3.	C-4.

D. Comments:

B-5. Manifest Information				
i. Date Shipped	ii. Manifest Document Number	iii. Internal Tracking Code	iv Receiving Facility ID	v. Quantity Shipped
05/02/97	25393	Line 28b	WAD991281767	354

GM Form--1997
GENERATION AND MANAGEMENT FORM

GM Form
ANSWER SHEET

EPA/State ID Number: WAD001882984	For Ecology Use Only: Date Received:
Site Name: Kaiser Aluminum-Tacoma Works	

A. Description of Dangerous Waste Stream

A-1. 63994 0006		
A-2. Coal Tar Oil containing PAHs		
A-3. ---		A-4. WP03, WT01
A-5. EHW	A-6. NO	A-7. A78
A-8. B206	A-9. i (Recurrent)	A-9a. ---

B. Waste Management Activities

B-1. 180 P			B-1a. ---------		B-2. Off-site	
B-3.					B-3a.	B-3b.
B-4.	i. Receiving Facility ID	ii. System Code	iii. Quantity	iv. Recycling percent	B-6.	
	WAD991281767	M061	180	0		

C. Waste Minimization Activities (Complete for odd (e.g. 95, 97) reporting years.)

C-1.	C-2.
C-3.	C-4.

D. Comments:

B-5. Manifest Information

i. Date Shipped	ii. Manifest Document Number	iii. Internal Tracking Code	iv Receiving Facility ID	v. Quantity Shipped
05/02/97	25393	Line 11b	WAD991281767	180

GM Form--1997
GENERATION AND MANAGEMENT FORM

GM Form
ANSWER SHEET

EPA/State ID Number: WAD001882984	For Ecology Use Only:
Site Name: Kaiser Aluminum-Tacoma Works	Date Received:

A. Description of Dangerous Waste Stream

A-1. 91468		0007
A-2. Used Cleaning Solvent Containing D-Limonene and Aliphatic Hydrocarbons		
A-3. D001		A-4.
A-5. DW	A-6. NO	A-7. A37
A-8. B203	A-9. i (Recurrent)	A-9a. ---

B. Waste Management Activities

B-1. 2,064 P			B-1a. ---------		B-2. Off-site	
B-3.					B-3a.	B-3b.
B-4.	i. Receiving Facility ID	ii. System Code	iii. Quantity	iv. Recycling percent	B-6.	
	WAD991281767	M061	2,064	0		

C. Waste Minimization Activities (Complete for odd (e.g. 95, 97) reporting years.)

C-1.	C-2.
C-3.	C-4.

D. Comments:

B-5. Manifest Information

i. Date Shipped	ii. Manifest Document Number	iii. Internal Tracking Code	iv Receiving Facility ID	v. Quantity Shipped
05/02/97	25393	Line 28c	WAD991281767	338
08/05/97	26330	Line 11a	"	1,726

GM Form--1997
GENERATION AND MANAGEMENT FORM

GM Form
ANSWER SHEET

EPA/State ID Number: WAD001882984	For Ecology Use Only: Date Received:
Site Name: Kaiser Aluminum-Tacoma Works	

A. Description of Dangerous Waste Stream		
A-1. 105155		
A-2. Cement Liquid		
A-3. ---		A-4. WT02
A-5. DW	A-6. NO	A-7. A57
A-8. B210	A-9. ii	A-9a. ---

B. Waste Management Activities						
B-1. 48 P			B-1a. ---------		B-2. Off-site	
B-3.					B-3a.	B-3b.
B-4.	i. Receiving Facility ID	ii. System Code	iii. Quantity	iv. Recycling percent	B-6.	
	WAD991281767	M061	48	0		

C. Waste Minimization Activities (Complete for odd (e.g. 95, 97) reporting years.)	
C-1.	C-2.
C-3.	C-4.

D. Comments:

B-5. Manifest Information

i. Date Shipped	ii. Manifest Document Number	iii. Internal Tracking Code	iv Receiving Facility ID	v. Quantity Shipped
05/02/97	25393	Line 11a	WAD991281767	48

GM Form--1997
GENERATION AND MANAGEMENT FORM

GM Form
ANSWER SHEET

EPA/State ID Number: WAD001882984	For Ecology Use Only: Date Received:
Site Name: Kaiser Aluminum-Tacoma Works	

A. Description of Dangerous Waste Stream

A-1. 105156		
A-2. Used X-Ray Tubes		
A-3. ---		A-4. WT02
A-5. DW	A-6. NO	A-7. A99
A-8. B316	A-9. i (Recurrent)	A-9a. ---

B. Waste Management Activities

B-1. 30 P			B-1a. ---------		B-2. Off-site	
B-3.					B-3a.	B-3b.
B-4.	i. Receiving Facility ID	ii. System Code	iii. Quantity	iv. Recycling percent	B-6.	
	WAD991281767	M141	30	0		

C. Waste Minimization Activities (Complete for odd Yr.'s. 95, 97 reporting years.)

C-1.	C-2.
C-3.	C-4.

D. Comments:

B-5. Manifest Information

i. Date Shipped	ii. Manifest Document Number	iii. Internal Tracking Code	iv Receiving Facility ID	v. Quantity Shipped
05/02/97	25393	Line 11c	WAD991281767	30

GM Form--1997
GENERATION AND MANAGEMENT FORM

GM Form
ANSWER SHEET

EPA/State ID Number: WAD001882984	For Ecology Use Only: Date Received:
Site Name: Kaiser Aluminum-Tacoma Works	

A. Description of Dangerous Waste Stream

A-1. 107246		0010
A-2. Containers of Old Mortar Product		
A-3. D002 D005 D007		A-4.
A-5. DW	A-6. NO	A-7. A57
A-8. B114	A-9. ii	A-9a. ---

B. Waste Management Activities

B-1. 2,400 P			B-1a. ---------		B-2. Off-site	
B-3.					B-3a.	B-3b.
B-4.	i. Receiving Facility ID	ii. System Code	iii. Quantity	iv. Recycling percent	B-6.	
	WAD991281767	M111	2,400	0		

C. Waste Minimization Activities (Complete for odd (e.g. 95, 97) reporting years.)

C-1.	C-2.
C-3.	C-4.

D. Comments:

B-5. Manifest Information

i. Date Shipped	ii. Manifest Document Number	iii. Internal Tracking Code	iv Receiving Facility ID	v. Quantity Shipped
08/19/97	26529	Line 11a (1of1)	WAD991281767	2,400

GM Form--1997
GENERATION AND MANAGEMENT FORM

GM Form
ANSWER SHEET

EPA/State ID Number: WAD001882984	For Ecology Use Only: Date Received:
Site Name: Kaiser Aluminum-Tacoma Works	

A. Description of Dangerous Waste Stream

A-1. 147800 0011		
A-2. Mercury Switches		
A-3. D009		A-4.
A-5. DW	A-6. NO	A-7. A99
A-8. B117	A-9. ii	A-9a. ---

B. Waste Management Activities

B-1. 50 P			B-1a. ---------		B-2. Off-site	
B-3.					B-3a.	B-3b.
B-4.	i. Receiving Facility ID	ii. System Code	iii. Quantity	iv. Recycling percent	B-6.	
	WAD991281767	M141	50	0		

C. Waste Minimization Activities (Complete for odd (e.g. 95, 97) reporting years.)

C-1.	C-2.
C-3.	C-4.

D. Comments:

B-5. Manifest Information

i. Date Shipped	ii. Manifest Document Number	iii. Internal Tracking Code	iv Receiving Facility ID	v. Quantity Shipped
05/02/97	25393	Line 11d	WAD991281767	50

OI Form--1997
OFF-SITE IDENTIFICATION INFORMATION FORM

OI Form
ANSWER SHEET

EPA/State ID Number: WAD001882984	For Ecology Use Only: Date Received:
Site Name: **Kaiser Aluminum-Tacoma Works**	

EPA ID Number:	ORD089452353
Name:	Chemical Waste Management of the Northwest
Address:	17629 Cedar Springs Lane, Arlington, OR 97812-9709
Handler Type:	TSDR
EPA ID Number:	ORD089452353
Name:	Chemical Waste Management of the Northwest
Address:	17629 Cedar Springs Lane, Arlington, OR 97812-9709
Handler Type:	Transporter
EPA ID Number:	ORD980579015
Name:	Secured Resource Transport, Inc.
Address:	8821 S.E. Lambert St., Portland, OR 97266
Handler Type:	Transporter
EPA ID Number:	WAD991281767
Name:	Burlington Environmental, Inc. - Kent Facility
Address:	20245 77th Avenue South, Kent, WA 98032
Handler Type:	TSDR
EPA ID Number:	WAR000001743
Name:	Burlington Environmental, Inc.
Address:	1629 East Alexander, Tacoma, WA 98421
Handler Type:	Transporter
EPA ID Number:	WAD000812909
Name:	Burlington Environmental, Inc.
Address:	734 So. Lucile St., Seattle, WA 98108
Handler Type:	TSDR
EPA ID Number:	IND042534875
Name:	Jack Gray Transport
Address:	
Handler Type:	Transporter
EPA ID Number:	NED001792910
Name:	Union Pacific Railroad
Address:	
Handler Type:	Transporter

Comments:

OI Form--1997
OFF-SITE IDENTIFICATION INFORMATION FORM

OI Form
ANSWER SHEET

EPA/State ID Number: WAD001882984	For Ecology Use Only:
Site Name: Kaiser Aluminum-Tacoma Works	Date Received:

EPA ID Number:	CAD000367755
Name:	Diablo Transportation
Address:	
Handler Type:	Transporter

EPA ID Number:	WAR000001263
Name:	Steve Forler Trucking, Inc.
Address:	
Handler Type:	Transporter

EPA ID Number:	
Name:	
Address:	
Handler Type:	

EPA ID Number:	
Name:	
Address:	
Handler Type:	

Comments:

END OF REPORT
(Attach this page as the last page of your submission)

KAISER ALUMINUM SLUDGE CLEANUP PROJECT

WASHINGTON STATE DEPARTMENT OF ECOLOGY

Public Comment Period Begins On Consent Decree

Public Comment Period: June 1, 1990 through June 30, 1990.

Ecology invites you to a public hearing on June 25, 1990 at 7:00 p.m. to explain the sludge cleanup project described in a proposed Consent Decree. The meeting will be held at the Pierce County Health Department auditorium located at 3629 South D Street in Tacoma. Public comments will be accepted for thirty days after the posting of this notice.

A legal agreement between Washington State Department of Ecology, Port of Tacoma, Puyallup Indian Tribe and Kaiser Aluminum and Chemical Corporation concerning the cleanup of the Kaiser Aluminum sludge site has been reached. The proposed agreement, called a Consent Decree, is a document that defines the scope of the cleanup work that will be performed at the site. The Decree describes cleanup responsibilities of both Kaiser Aluminum and Chemical Corporation and the Department of Ecology. Following public comment and consideration of all comments received, the proposed decree will be filed in Superior Court and the effort to cleanup the site will proceed.

The State Environmental Policy Act (SEPA) must be followed for all hazardous waste cleanup projects conducted under the Model Toxics Control Act – Cleanup. Kaiser submitted SEPA checklists for the cleanup to Ecology on April 6, 1990. Ecology has determined that the proposed actions represent no adverse impact to human health or the environment and, thus, is issuing a Declaration of Nonsignificance (DNS). This DNS was published in the SEPA Register on April 23, 1990.

The Consent Decree, together with a Cleanup Action Plan (CAP) are available for public review and comment through June 30, 1990. The box at the right provides information on where the documents are available for review and how to submit comments to Ecology. Detailed technical information describing the site and the cleanup can be found at the Department of Ecology, Industrial Section in Olympia. Ecology will hold a public hearing on June 25, 1990 at 7:00 p.m. at the Tacoma Health Department. This meeting will give you information on the contents of the proposed Consent Decree and provide you with an opportunity to give oral comments on the Decree. The comment period for the Consent Decree will end on June 30, 1990.

Kaiser Sludge Cleanup Background

Kaiser Aluminum and Chemical Corporation currently operates an aluminum smelter on the Tacoma Tide Flats. The facility consists of approximately 400 Soderburg type reduction cells. The plant was

Continued on Page 2

FACT SHEET

May 1990

DETAILED TECHNICAL INFORMATION ON THIS SITE MAY BE FOUND AT:

Washington Department of Ecology
Industrial Section
Mail Stop PV-11
Olympia, WA 98504-8711

INFORMATION REPOSITORIES:

Washington State Dept. of Ecology
Industrial Section
2404 Chandler Court S.W.
Suite 260
Olympia, WA 98502

Tacoma Pierce County Health Dept.
3629 South "D" St.
Tacoma, Washington

Tacoma Public Library
1102 Tacoma Avenue South
Tacoma, Washington

For a copy of this fact sheet or if you need more information concerning the Kaiser Sludge Cleanup Project write or call:

Mr. Paul Skyllingstad
Department of Ecology
MS: PV-11
Olympia, Washington 98504-8711
(206) 586-0583

Written comments should be sent to Paul Skyllingstad at the Industrial Section.

May 1990
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Continued From Page 1

constructed in 1942 as part of the wartime defense effort. The plant is located at 3400 Taylor Way in Tacoma. The property surrounding the plant is used for industrial purposes.

The aluminum production process is an electrochemical reduction process. Alumina ore is dissolved in a bath of molten salts at an operating temperature of approximately 1760 degrees F. An electrical current is passed through the molten salts, reducing the dissolved alumina to aluminum. The metal settles in a molten pool at the bottom of the reduction cell. A combination of coal tar pitch fumes, alumina, and salt dust is emitted during the reduction process. In 1950, the plant installed then state of the art wet emission control technology to capture hydrogen fluoride gasses that were generated from the reduction process. The equipment utilized water sprays to scrub the pollutants from the captured process gasses. After reacting with the process gasses, the scrubber waters contained very fine grained particulate composed of alumina, calcium fluoride, carbon and coal tar pitch derivatives. The scrubber waters were directed to a series of settling basins on the plant property. In the settling basins, solids were separated forming the sludge. In 24 years of wet scrubber system operation, as much as 82,000 cubic yard of solids were generated and remain on site.

The sludge has been tested both chemically and biologically. The scrubber sludge is composed of alumina, with lesser amounts of carbon, fluoride compounds, and coal tar pitch derivatives. The contaminants of interest and concern in the sludge are coal tar pitch derivatives, that are generally referred to as polynuclear aromatic hydrocarbon (PAH) compounds. Polynuclear aromatic hydrocarbons include a broad grouping of organic chemicals, some of which are known or suspected human carcinogens. Kaiser sludge contains several known or suspected human carcinogen PAH compounds in concentrations that are considered dangereous. In addition to chemical characterization, the sludge was subjected to toxicity leach testing. The sludge does not exhibit toxicity as defined by the leaching extraction procedure. The only chemicals that were detected above the detection limits of the procedure were polynuclear aromatic hydrocarbons and aluminum. The sludge passes in situ bioassay testing.

The sludge was brought to the attention of Ecology in 1983. At that time, Kaiser Aluminum was conducting preliminary engineering studies related to a proposed plant expansion. During geotechnical drilling, the sludge was discovered and reported to Ecology. Ecology, through a series of water quality orders, required Kaiser Aluminum to protect the immediate environment from the potential hazard of the sludge, characterize the site and the area, determine a final cleanup scenario for the contaminated area, and determine if the ground water in the area was effected by the sludge. Monitoring and field work was completed in 1987. Further sampling and analysis of the chemical composition of the sludge was completed during the summer and fall of 1989. The series of orders constituted a remedial investigation of the site. In the fall of 1989, Clement Associates completed a risk assessment of the four cleanup alternatives that could be implemented on the site.

The results of the studies conducted on the sludge indicate that:

- The quantity of sludge present on the site is approximately 82,000 cubic yards.
- The only chemicals of concern in the sludge are polynuclear aromatic hydrocarbons (PAH).
- The PAH sludge, if characterized today, would designate as dangereous waste due to carcinogenic properties.
- The ground water adjacent to the sludge beds shows no evidence of PAH migration.
- The pond water found in the waste lagoons passed in situ bioassay tests.

Continued on page 3

Continued From Page 2

- The transport mechanism of the Kaiser PAH compounds appears to be via the movement of solid particles. The PAH compounds of concern have very low solubilities.
- The highest potential risk of the sludge in its PRESENT condition is from direct contact. This risk is estimated to be a carcinogenic risk of 2 in 100,000.

Ecology and Kaiser have agreed on one of five cleanup alternatives. The proposed cleanup action consists of excavation and consolidation on site of soils and sludges contaminated with polynuclear aromatic hydrocarbon compounds (PAH). The cleanup involves removing and transporting 11,000 cubic yards of sludge to existing sludge containing lagoons on the site. The lagoon areas will be drained then filled and covered with geotextile material and clean soil. The excavated areas will be graded to adequately drain surface water from the site. The cleanup will also remediate the "Kaiser Drainage Ditch". Kaiser will install and cover two new drainage lines in the drainage ditch. Areas where the sludge is removed will be cleaned to Cleanup Standards that are described in the Consent Decree. Areas where sludge remains on the facility in concentrations greater than 1 ppm carcinogenic PAH will have a residential restriction placed in the deed.

What will the Consent Decree do?

The cleanup will consolidate, monitor and control sludge that is now found on the Kaiser site. The action will remove contaminated soils from Puyallup Tribal Lands and allow the land to be used as an industrial site. The company will be required to close an exposed drainage ditch and pipe its storm water and non-process cooling water to the Hylebos waterway. The site will have ground water monitoring for at least thirty years. The cleanup standards are outlined in the Consent Decree.

How long will the cleanup take?

The design phase of the project is complete. The construction phase cleanup project will take about six months after approval of the proposed Consent Decree. The closure of the Kaiser Drainage Ditch will occur in one year. The final storage area will have ground water monitoring for thirty years past the completion of the remedial action. If ground water monitoring indicates PAH contamination or new data indicates previously undiscovered contamination, then Kaiser will be brought back into the cleanup process.

Who will carry out the Consent Decree? How much does it cost?

Kaiser Aluminum and Chemical Corporation will conduct the cleanup. Ecology will monitor the activities and approve the final project. The estimated cost of the project is between $400,000 and $500,000 dollars. Kaiser will pay Ecology for its current and future oversight costs.

Where can I get a copy of the Consent Decree?

Copies of the Consent Decree and Cleanup Action Plan will be available for review at the information repositories listed on the first page of this fact sheet. You can also get a copy upon request to the Department of Ecology. You will be charged copying costs for the Decree. Data and detailed information about the project can be reviewed at the Department of Ecology, Industrial Section, Olympia, Washington.

Questions?

Call or write: Paul Skyllingstad, Department of Ecology, Mail Stop PV-11, Olympia, WA 98504-8711; telephone: (206) 586-0583.

KAISER SLUDGE FACT SHEET

In March of 1983 large quantities of sludge were discovered on the Kaiser-Tacoma plant site. Analysis of the sludge indicates that the material contains PAH at 4-5 percent concentration. Bioassay tests on the sludge indicates that the material qualifies as EHW under state regulations.

The sludge was produced prior to 1974 when the plant air pollution control system used wet scrubbers for the treatment of aluminum reduction cell off gases. More than 60,000 cubic yards of sludge are present on the plant site. Analysis of the sludge indicates that the sludge contains greater than five percent PAH. The original CH2M Hill soil survey samples had 5.2% PAH (4.5% air dried) and were saturated with water (50% water). From 1983 to 1985 the Department required Kaiser through a series of 90.48 orders to protect the immediate environment from the potential hazard of the sludge, characterize the site and sludge, and determine a final cleanup scenario for the contaminated area.

In 1983 a decision was made by WDOE management that it was appropriate to view the possible remedial action at Kaiser as a one time situation that would not require total and absolute regulation. Since that time there has been considerable discussion with WDOE and Kaiser concerning the final solution of the sludge cleanup. The WDOE in 1984 ordered Kaiser to move and secure sludge that was not on the companies property. In 1985 three alternatives were discussed: a) leave the sludge in place with appropriate containment, b) recycle/reuse and c) disposal at a hazardous waste site. Kaiser preferred to leave the material in place since that option would not trigger the Hazardous Waste regulations at that time. Before the department would make a final decision Kaiser was required to conduct a two year study to determine if PAH was migrating in the ground water under the site and develop plans for final disposal of the sludge. The study was completed in the summer of 1987 and the following was determined:

1. The sludge pollutants show no evidence of moving in ground water.

2. The pollutants are not very soluble in water and tend to cling to solids.

3. The highest potential public risk involves direct contact with the sludge.

4. The proposed remedial action of consolidating the sludge and covering any exposed material with a cap was acceptable and should be implemented.

Prior to finalizing a cleanup order, Industrial Section staff met with the hazardous waste cleanup staff to determine appropriate cleanup levels. The cleanup staff stated that the regulations prohibit Kaiser from implementing their preferred option because the company would become a EHW generator under WAC 173-303 and RCW 70.105.050(1). Generators of EHW have to dispose of the material in a EHW approved site and the nearest EHW site is Arlington, Ore. Remember that in 1983 WDOE management approved looking at the Kaiser sludge problem as a one time treatment and/or disposal problem that did not require total and absolute regulation.

In 1987/88 Jay Manning (AAG) rendered the opinion that the Department can allow a deviation from the standard contained in RCW 70.105.050 concerning the disposal of EHW in the state. It was suggested to Kaiser that they propose to cleanup the sludge site using RCW 70.105B and a consent decree. Kaiser submitted a consent decree and agreed to sample near the facility to determine background levels for cleanup.

In 1988 RCW 70.105B was repealed. The AAG assigned to the cleanup project in 1988 submitted a new option that stated that Kaiser has to remove all material that they generated in 1984 (greater than 2,300 cubic yds.) to a EHW facility. The company also has to develop a plan to remove or recycle the remaining 63,000 cubic yards of material rather than leaving the material on site. The hazardous waste cleanup program also concurs with this proposal. This is a complete reversal from the Departments stance in the 1987. The cost to remove the material generated in 1984 (approx.>2300 cu. yds) is greater than one million dollars. The decision to order the company to remove the remaining sludge to an approved EHW site has never been completely evaluated because of the very high cost. Estimates for over 16 million dollars have been made by the company.

Below is a list of important dates and actions concerning the sludge cleanup from discovery to present.

- 2/24/83 - Meeting with WDOE/County/EPA
- 4/11/83 - Sludge bioassay 100% Mortality @ 1000 ppm
  73% Mortality @ 100 ppm
- 4/19/83 - Ecology Order No. DE 83-197 Preform a study to determine the quantity and characteristics of the sludge. Preform a sampling program for surface waters, ground waters, and sediments. The terms and conditions of the order have been satisfied with Kaiser 6/30/83 report.
- 4/21/83 - Received proposed study plan.
- 6/30/83 - Received sludge investigation results
- 7/05/83 - Memo from Burkhalter to Provost concerning an order requiring (a) drainage and run-off control to prevent the escape of the sludge to Hylebos waterway and (b) planning to treat and/or dispose of the sludge.
- 8/15/83 - Ecology Order No. DE 83-386 An order that required drainage and run-off control to prevent the escape of sludge to the Hylebos waterway and studies to determine the ultimate disposal and/or treatment of the sludge.
- 9/09/83 - Letter from Deputy Director WDOE to Kaiser suggesting that Kaiser petition Department to allow the one time treatment and/or disposal of the sludge.
- 11/04/83 - Silt curtain completed.

- 11/22/83 - Tidal gate installed.

- 3/30/84 - Sludge dewatering tests approved.

- 7/17/84 - WDOE approval to move sludge in part of area III, excavate a new settling pond, and divert process and storm water from area I.

- 9/27/84 - Project to remove sludge and reroute storm water complete.

- 6/04/85 - Ecology Order DE 85-435 An order that suspends DE 83-386 item C and requires the company to begin a two year ground water monitoring program and develop plans for ultimate disposal or treatment of the sludge. The order also required Kaiser to:
    - conduct a ground water monitoring study over the next two years in accordance with WAC 173-303-645.
    - secure or remove sludge from under log dump access road.
    - evaluate sludge storm water and wind erosion, and monitor storm water discharges for PAH constituents.
    - modify the property description in the deed to include notification of the existence of the sludge.

- 6/01/87 - Final report and plan submitted to WDOE.

- 3/08/88 - Kaiser submits a draft consent decree for sludge project.

- 10/14/88 - Kaiser submits final background sample locations for WDOE approval.

- 11/21/88 - WDOE and Kaiser collect background samples for sludge project.

- 11/30/88 - Industrial Section meeting with Assistant Attorney General and Hazardous waste cleanup. Problems with cleanup plan addressed. The positions stated by AAG and HWCU are:

    1) Kaiser must remove all generated PAH material to a EHW site. Over 2300 cubic yards at a cost of over one million dollars.

    2) Kaiser must conduct a study to determine if there are any viable recycle alternates for the disposal of the sludge. Unknown cost.

    3) Kaiser must either recycle or remove the sludge from the plant site to a EHW disposal site. Over 61,000 cubic yards at a cost of over 16 million (1987) dollars.

REPORT OF SAMPLING AND TESTING

HYLEBOS WATERWAY, TACOMA, WASHINGTON

FOR

KAISER ALUMINUM & CHEMICAL CORPORATION

22 February 1984

TABLE OF CONTENTS

SUMMARY

In a letter to Kaiser Aluminum dated 16 August 1983 the Washington State Department of Ecology (WDOE) issued a request to Kaiser Aluminum to study the sediment composition in the Hylebos Waterway in the vicinity of the ditch leading from Kaiser property.

This report presents the results of an investigation which included obtaining and testing 24 sediment samples from 7 locations in the Hylebos Waterway and comparing the results to previous studies by Kaiser and others.

The results of this study lead to the following conclusions and recommendations:

1. There is no evidence of contemporary deposition of PAH's from the Tacoma works in the Hylebos Waterway, as evidenced by the absence of PAH's in the upper sediment at concentrations above background levels and because the PAH's in the upper sediments do not exibit the same chemical "fingerprint" as that identified for the Kaiser Aluminum wet scrubber sludge.

2. U.S. Army Corps of Engineers data indicate that deposits of PAH's from the Tacoma works which may have existed in mid-channel have been removed by maintainance dredging by the Corps or scoured by ship traffic and that any deposits remaining are limited to the undredged waterway slopes.

3. Based on plant records of wet scrubber operation, and maintainance dredging records for the settling ponds, it is likely that the sludge-contaminated deposits found in the Hylebos Waterway near the Kaiser ditch are primarily due to overflow during hydraulic dredging of the settling ponds in 1969 and 1971.

4. The sediments attributable to Kaiser sludge are buried under more recent deposits and, since they are not in the biologically active zone, may safely be allowed to remain in place, at least until the waterway is next dredged. Removal of the PAH contaminated sediment, if necessary, should be undertaken as part of the dredging program.

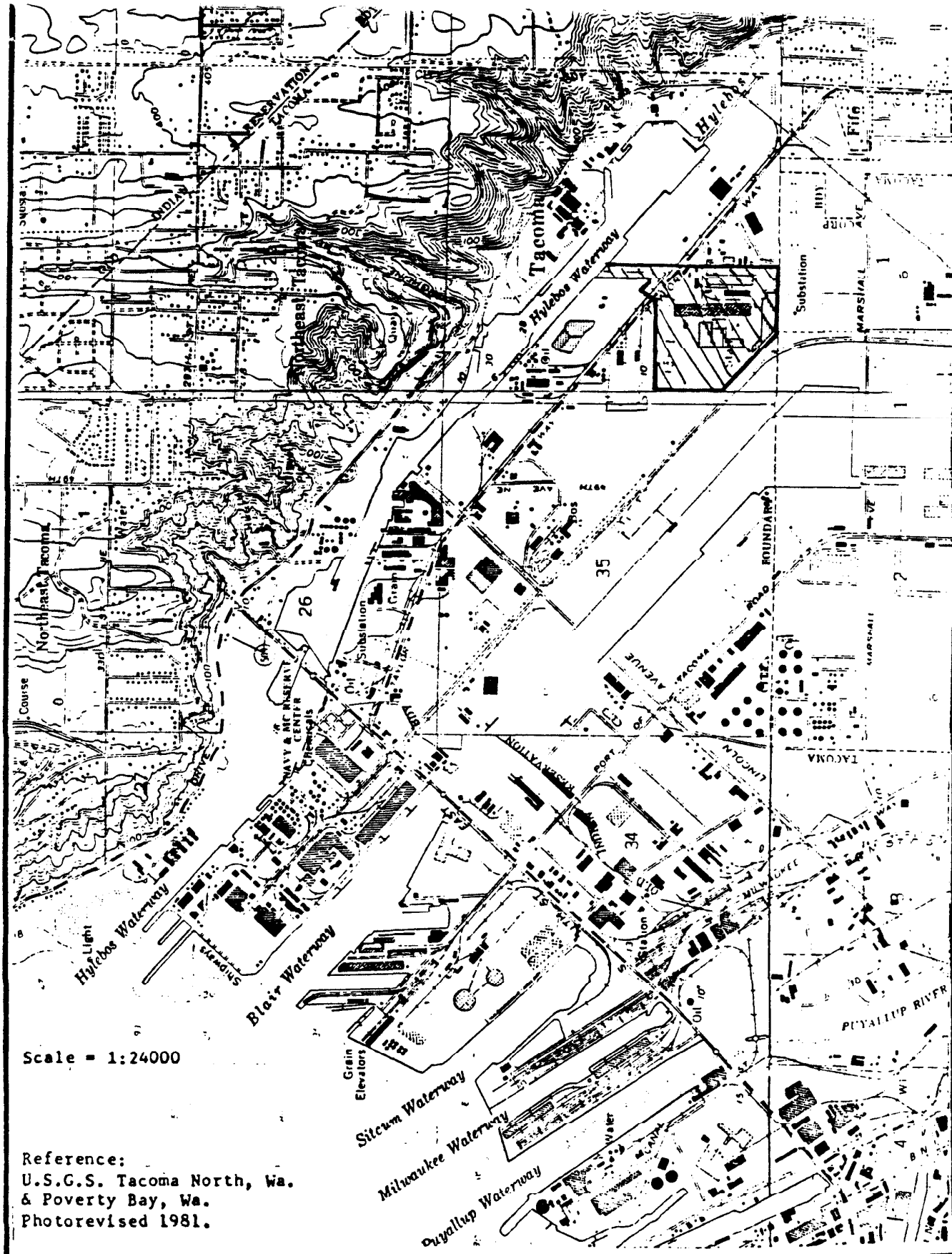
5. Further effort to establish the lateral distribution and quantitative estimates of sediments which incorporate PAH's from the Tacoma works should be deferred until it is determined whether remedial action is necessary and the cleanup criteria are better defined. Such criteria are necessary to define sampling and testing procedures.

LANDAU ASSOCIATES
GEOTECHNICAL ENGINEERING AND HYDROLOGY
P.O. BOX 694
EDMONDS, WASHINGTON 98020
(206) 542-4917

INTRODUCTION

Prior to 1974 Kaiser Aluminum's Tacoma facility (Figure 1), generated a sludge from their wet air scrubbers which has been shown to contain up to about 5 percent polycyclic aromatic hydrocarbons (PAH's). Studies undertaken by the Washington State Department of Ecology (WDOE), the Environmental Protection Agency (EPA), the National Oceanographic Atmospheric Administration (NOAA), and Kaiser Aluminum have identified detectable levels of PAH's in the Hylebos Waterway and in the ditch leading from Kaiser property to the waterway. Because of this apparent link between Kaiser and the waterway, the Department of Ecology issued a request to Kaiser Aluminum dated 16 August 1983 to study the sediment composition in the vicinity of the ditch discharge.

Kaiser Aluminum sampled and tested the ditch sediments in August 1983 and obtained samples in the Hylebos Waterway near the ditch discharge in early October 1983. During a meeting on 18 October 1983, involving representatives from the Washington State Department of Ecology, Kaiser Aluminum and Chemical Corporation and their consultants, Kaiser presented the results of the ditch sampling and agreed to perform a limited sampling program in the waterway.



Reference:
U.S.G.S. Tacoma North, Wa.
& Poverty Bay, Wa.
Photorevised 1981.

LANDAU ASSOCIATES	VICINITY MAP

Figure 1

SCOPE

The purpose of this investigation was to review the available information related to sedimentation in the Hylebos Waterway and to sample and analyze sediment at selected locations in the waterway to determine PAH levels. Specifically the scope included:

A. Reviewing bathymetric records compiled by the U.S. Army Corps of Engineers to determine sedimentation and accretion patterns in the waterway.

B. Reviewing plant operation procedures to identify the possiblity of historic releases of Kaiser sludge to the waterway.

C. Obtaining sediment core samples at 7 selected locations using an Osterberg type core sampler. The cores were intended to extend through the recent sediment into the native alluvial soil.

D. Transmitting the samples to Kaiser Aluminum's Center for Technology (CFT).

E. Analyses of the samples for PAH by Kaiser CFT.

F. Archiving duplicate samples for possible future testing.

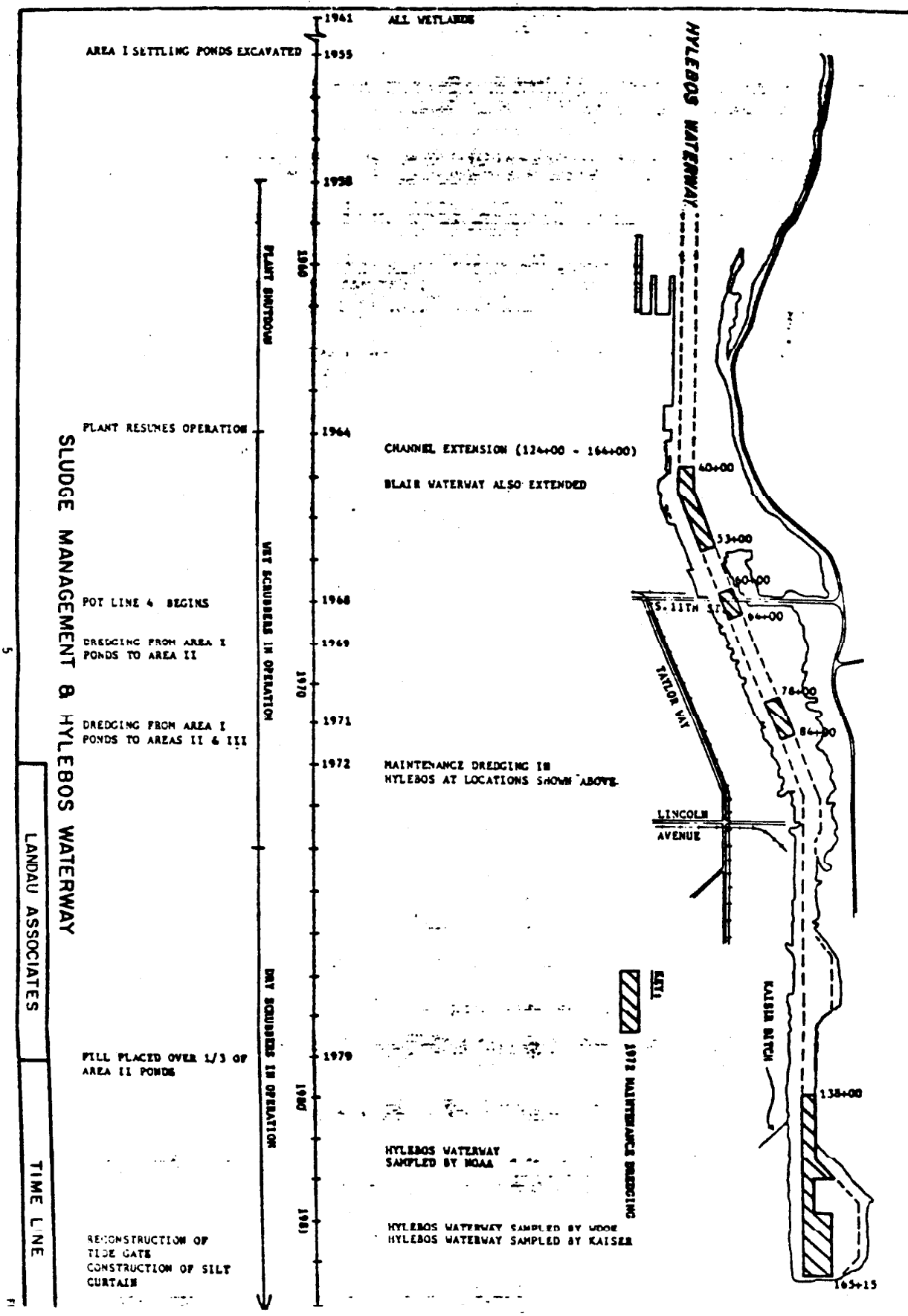
G. Comparing the results of physical and chemical testing with existing data in order to establish the relationship of past releases into the waterway to any present contaminant loading to the waterway; and to provide a rough estimate of the amount of PAH contaminated sediment in the waterway which may be attributed to Kaiser operations.

HISTORY OF SLUDGE MANAGEMENT

The scrubber sludge accumulated on the plant site consists mainly of solids derived from recycled scrubber water in an air control system. The solids were deposited in settling basins, including several ponds west of potline 4. These ponds are the subject of an ongoing investigation by Kaiser. The wet scrubber system ceased operation in 1974 and was replaced by a dry scrubber system which deposited no scrubber waste to the ponds. Since 1974 the only PAH's reaching the settling basins are small amounts conveyed by storm water runoff.

The settling ponds were dredged on two occasions during the use of the wet scrubber system. The time sequence of dredging operations in relation to other significant events is shown on the time line, Figure 2. During dredging, the scrubber sludge was redeposited in two areas (Areas II and III) west of the ponds (Area I). Records in Kaiser files indicate that 35,080 cubic yards (roughly 19,400 dry tons) of sludge were dredged in 1969 and 28,534 cubic yards (roughly 15,800 dry tons) were dredged in 1971 for a total of 63,614 cubic yards (35,200 dry tons).

Kaiser Aluminum recently prepared an estimate of the quantity of sludge remaining in the Area I ponds and in the diked disposal areas (Areas II and III) to the west. Kaiser reported this information to the Department of Ecology during a meeting on 30 June 1983. The estimated quantities are 32,500 cubic yards (18,000 dry tons) of sludge in the ponds


SLUDGE MANAGEMENT & HYLEBOS WATERWAY
LANDAU ASSOCIATES
TIME LINE
1961
1955
1958
1960
1964
1968
1969
1970
1971
1972
1979
1980
1981
ALL WETLANDS
AREA I SETTLING PONDS EXCAVATED
PLANT SHUTDOWN
PLANT RESUMES OPERATION
CHANNEL EXTENSION (124+00 - 164+00)
BLAIR WATERWAY ALSO EXTENDED
WET SCRUBBERS IN OPERATION
POT LINE 4 BEGINS
DREDGING FROM AREA I PONDS TO AREA II
DREDGING FROM AREA I PONDS TO AREAS II & III
MAINTENANCE DREDGING IN HYLEBOS AT LOCATIONS SHOWN ABOVE
DRY SCRUBBERS IN OPERATION
FILL PLACED OVER 1/3 OF AREA II PONDS
HYLEBOS WATERWAY SAMPLED BY NOAA
HYLEBOS WATERWAY SAMPLED BY WDOE
HYLEBOS WATERWAY SAMPLED BY KAISER
RECONSTRUCTION OF TIDE GATE
CONSTRUCTION OF SILT CURTAIN
HYLEBOS WATERWAY
40+00
53+00
60+00
64+00
76+00
84+00
S. 11TH ST.
TAYLOR WAY
LINCOLN AVENUE
1972 MAINTENANCE DREDGING
FILL
KAISER DITCH
138+00
165+15

(Area I), 22,900 cubic yards (23,800 dry tons) in the area north of potline number 5 (Area II), and 7,600 cubic yards (4,600 dry tons) in the area to the west (Area III). The estimated accuracy of the quantities is about ± 10 percent for Area I. For Area II and III the measured amounts are probably less than the actual amount; the estimated accuracy of the measurement is from 90 to 120 percent of the actual amount for these two areas. The reduced accuracy for Areas II and III is due to greater variability in sludge depths, burial by clean fill, variation in water content, and mixing with native soil.

Since the sludge was transferred from the ponds to the diked areas by hydraulic dredge, it is likely that some sludge escaped with the effluent water and entered the Kaiser ditch where it was transported to the Hylebos Waterway. It is also likely that rainfall erosion and erosion caused by flooding in Area II during extreme high tides, carried additional sludge to the waterway. Although the volume and weight measurements described above are not exact, they indicate that several hundred to several thousand tons of sludge could have escaped to the waterway.

Kaiser Aluminum has recently taken the necessary steps to prevent additional erosion. These included re-establishment of a tide gate at the confluence of the Kaiser ditch with the Hylebos Waterway and the construction of a silt curtain along the east side of Area II ponds.

TABLE 1

Bylebos Waterway - Sediment Patterns

Source	Interval	Based on Station	Maximum Accretion	Average Accretion	Approximate Area Affected (Waterway) Along	Across	Sediment Distribution
Bylebos Creek	1965-1972 (pre-dredge)	165 + 00	96'	68'	1500'	365'	Apparent delta deposit at Station 165+00 at confluence of Bylebos Creek and New Turning Basin, and extending as far downstream as Station 150+00.
	1972-1982 (post-dredge)	165 + 00	46'	25'	700'	170'	Apparent subdued delta deposit at Station 165+00, at confluence of Bylebos Creek and New Turning Basin, and extending as far downstream as Station 150+00.
Kaiser Tide Gate	1965-1972 (pre-dredge)	140 + 00 142 + 00	134'	61'	150'	280'	Apparent delta deposit opposite mouth of Kaiser Ditch along channel axis between Stations 136+00 150+00.
	1972-1976 (post-dredge)	140 + 00 142 + 00	13'	4.3'	200'	140'	Apparently negligible sedimentation along channel axis opposite mouth of Kaiser ditch.
	1972-1982 (post-dredge)	140 + 00 142 + 00	25'	10.4'	200'	140'	Apparent scour along channel axis opposite mouth of Kaiser Ditch. Some apparent upstream and downstream sedimentation.
	1976-1982 (post-dredge)	140 + 00 142 + 00	26'	-0.05'	200'	140'	Scour between 1982 and 1976 opposite mouth of Kaiser ditch.
Channel Slopes	1965-1972 (pre-dredge)	138 + 00 140 + 00 142 + 00	186'	42'	400'	115'	Apparent sloughing of sediment on channel slopes along length of Bylebos Waterway. A representative segment was chosen between 138+00 and 142+00 for the eastern channel slope.
	1972-1976 (post-dredge)	140 + 00 142 + 00	Insufficient data		Insufficient data		Channel slope sloughing negligible for 1972-1976; no estimate could be made for 1976-1982, due to lack of sounding data outside of the 200 foot wide channel.
	1972-1982	Insufficient data					
Drainage Ditch Near Bylebos Boat Haven	1965-1972 (pre-dredge)	124 + 00	220'	Insufficient data	Insufficient data		Suspected delta deposit near Station 121+00 at confluence of drainage ditch and Old Turning Basin. Sediment thickness may reach a maximum of 220 inches.
	1972-1982 (post-dredge)	124 + 00	48'	Insufficient data	Insufficient data		Suspected subdued delta deposit near Station 121+00 at confluence of drainage ditch and Old Turning Basin. Sediment thickness may reach a maximum of 48 inches.

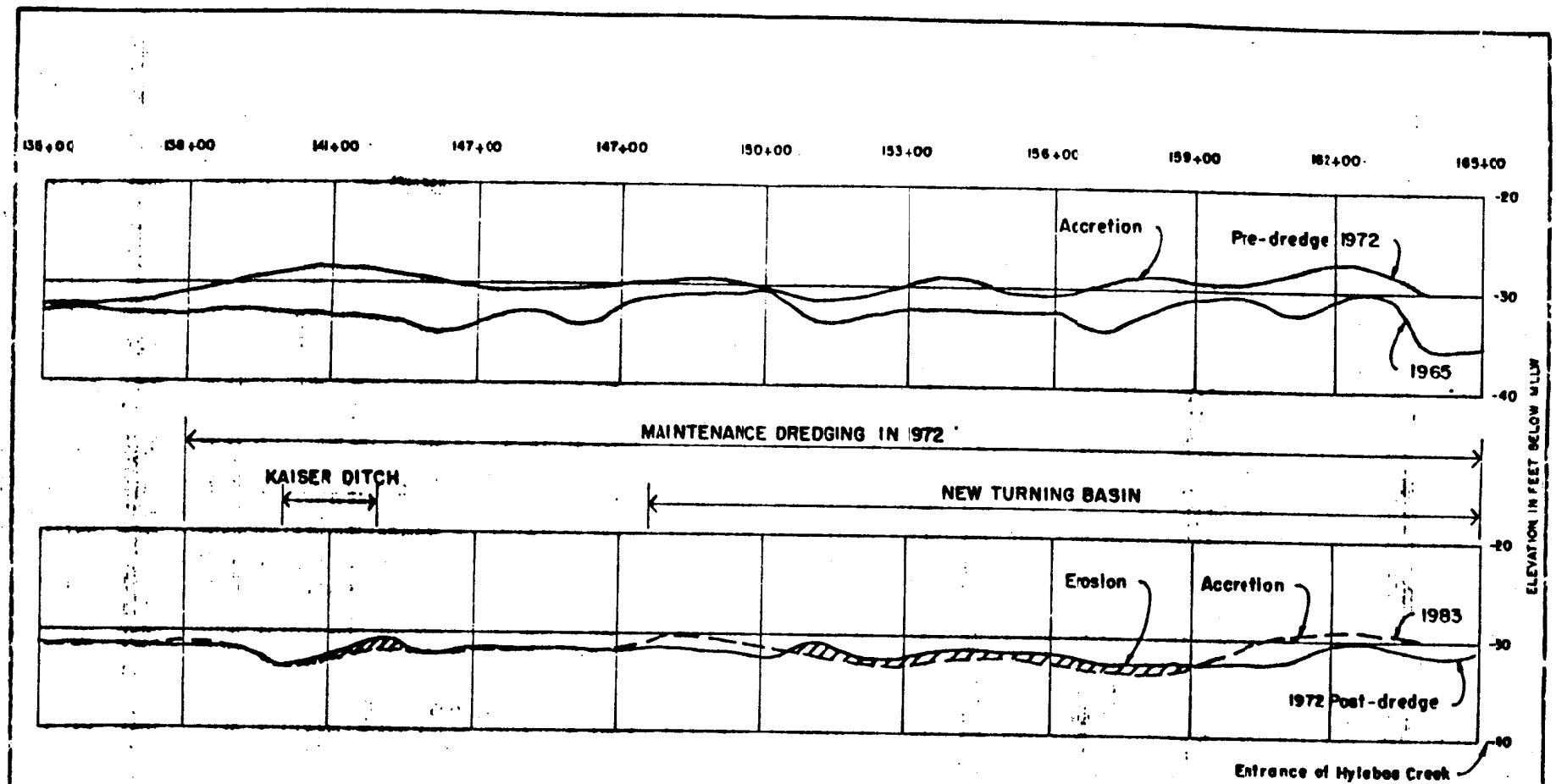
HISTORY OF HYLEBOS WATERWAY DEVELOPMENT

The Port of Tacoma industrial area on which the Kaiser Aluminum Tacoma facility is located, is a wetlands area which has been filled over the years. Much of the fill material was obtained from dredging the waterways. The history of the waterway, including records of the U.S. Army Corps of Engineers, was studied to aid in planning and interpreting the sampling program.

Prior to 1964, the Hylebos Waterway terminated near the outer turning basin. In that year it was extended to its present terminus as indicated on Figure 2. During 1972 the Army Corps of Engineers performed maintenance dredging in the vicinity of the Kaiser ditch. The location of the ditch and the segments dredged are shown on Figure 2. The total quantity dredged in 1972 was about 120,000 cubic yards. This included 74,400 cubic yards east of the Kaiser ditch between stations 139 + 00 and 165 + 15.

Since about 1965 the Corps of Engineers has performed bathymetric surveys along the Hylebos Waterway at a frequency of 1 to 2 years. The surveys provide valuable information which can be used to assess the amount of soil accreted or eroded at various locations in the waterway. The surveys included track lines along the length of the waterway and transverse sections from 50 to 200 feet apart.

The Corps of Engineers dredging records have been reviewed and the results summarized on Figures 3 to 9. Figure 3 summarizes soundings along the channel center line for the period from 1965 to 1972 (pre-1972 maintenance



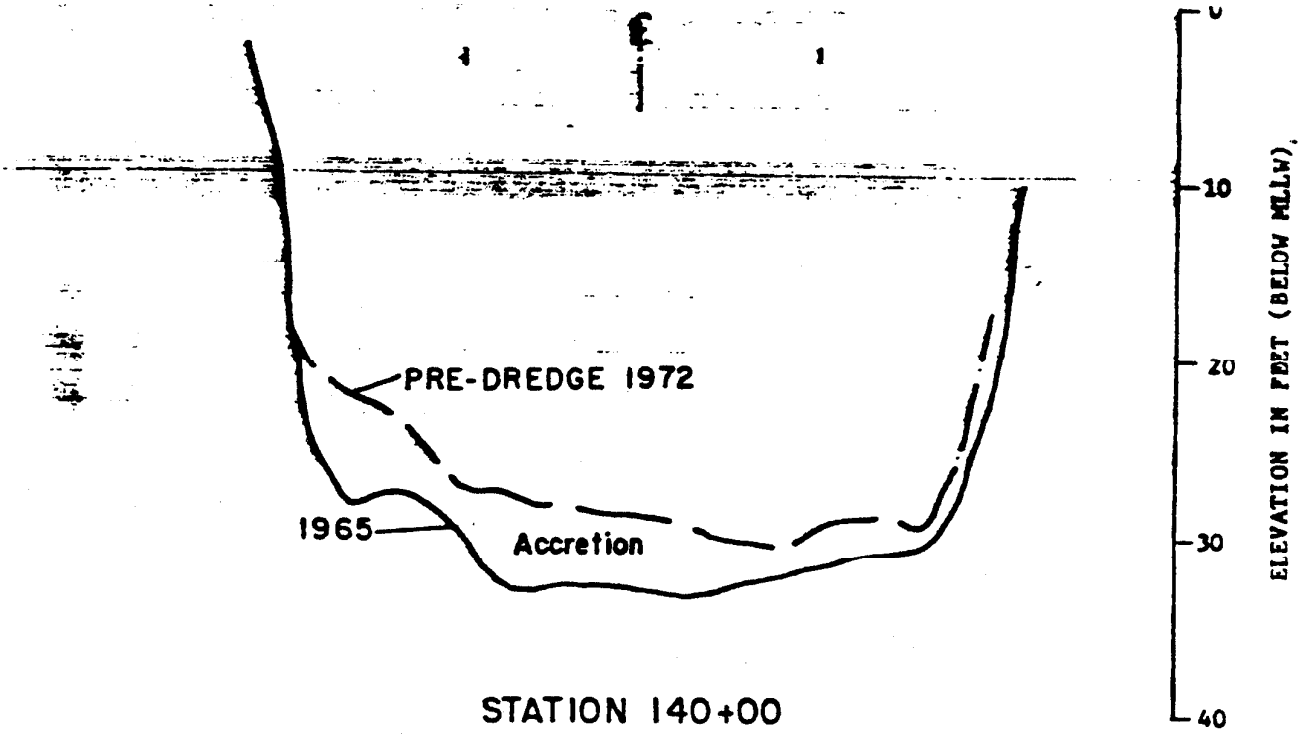
Hylebos Waterway

SOUNDINGS ALONG CHANNEL CENTERLINE

HORIZONTAL SCALE: 1" = 200'
VERTICAL SCALE: 1" = 10'

LANDAU ASSOCIATES	PROFILE

Figure 3



STATION 140+00

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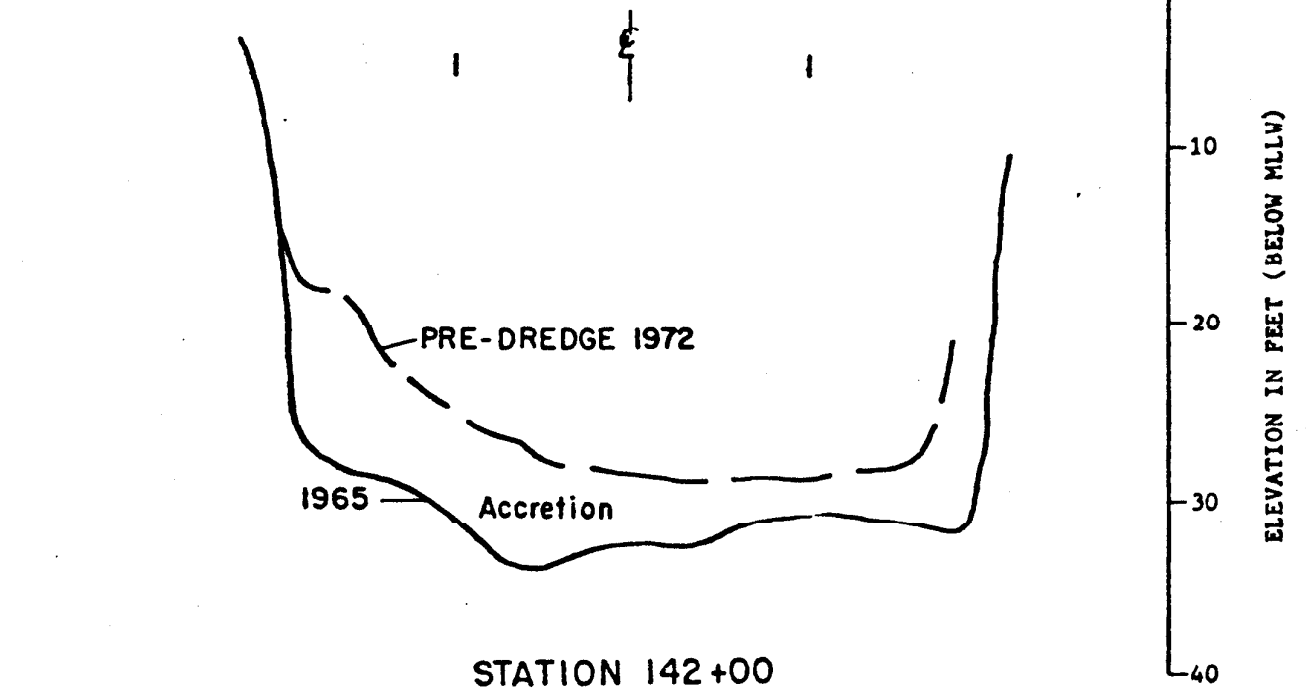
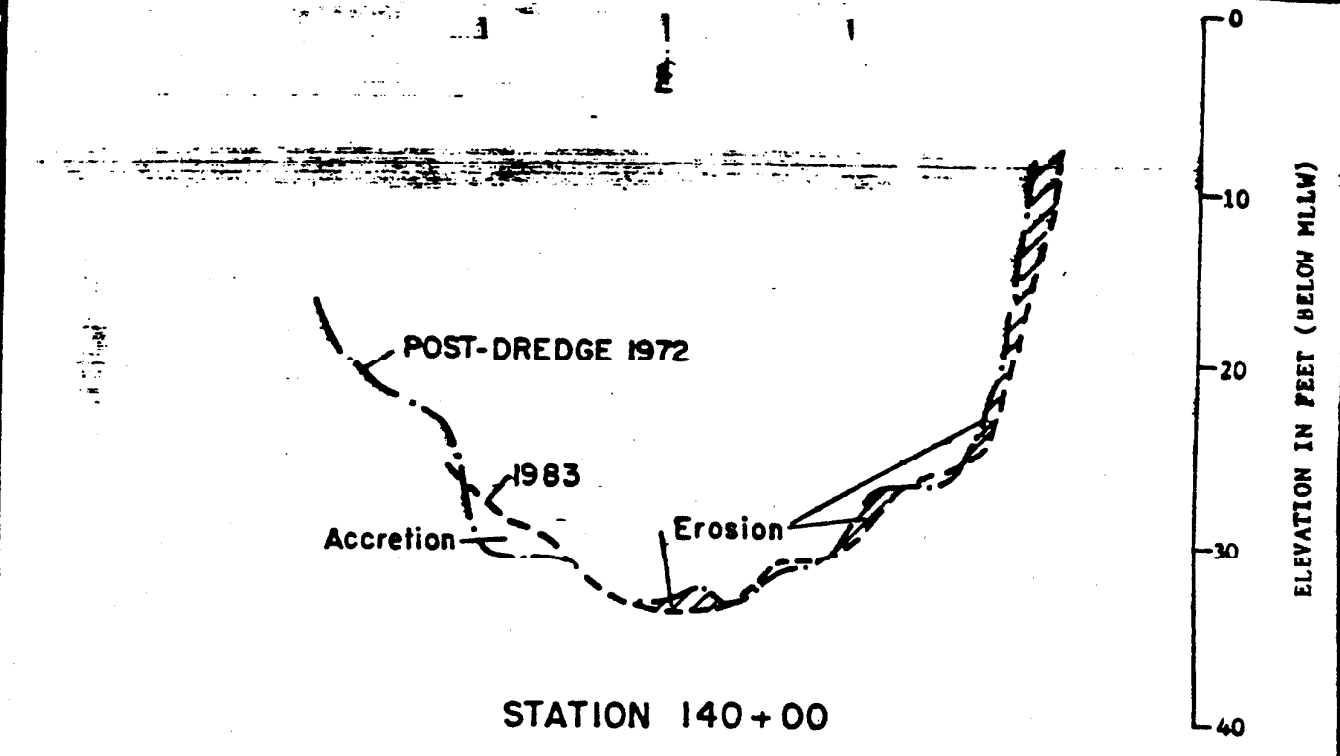


STATION 142+00

HYLEBOS CROSS-SECTIONS, KAISER DITCH, STATIONS 140+00 AND 142+00, YEARS 1965 AND 1972 (PRE-DREDGE)

LANDAU ASSOCIATES	CROSS-SECTIONS

Figure 4



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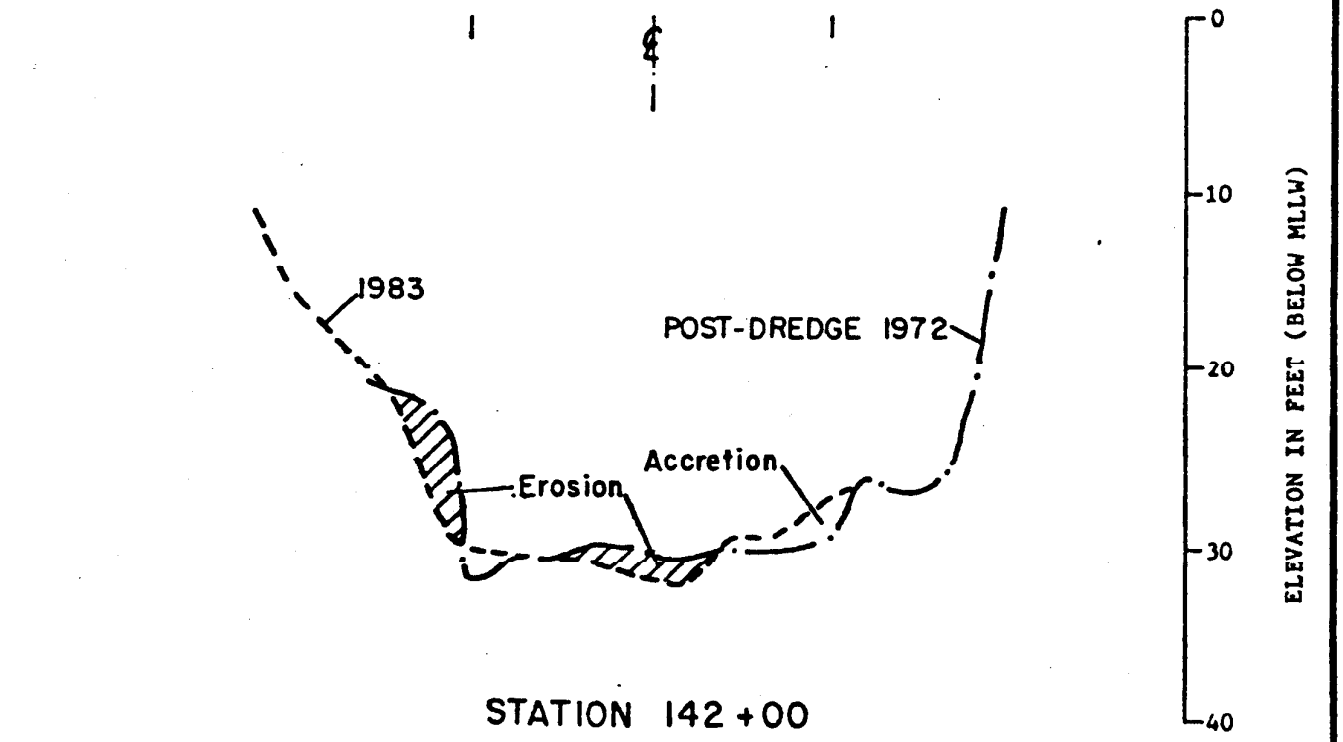
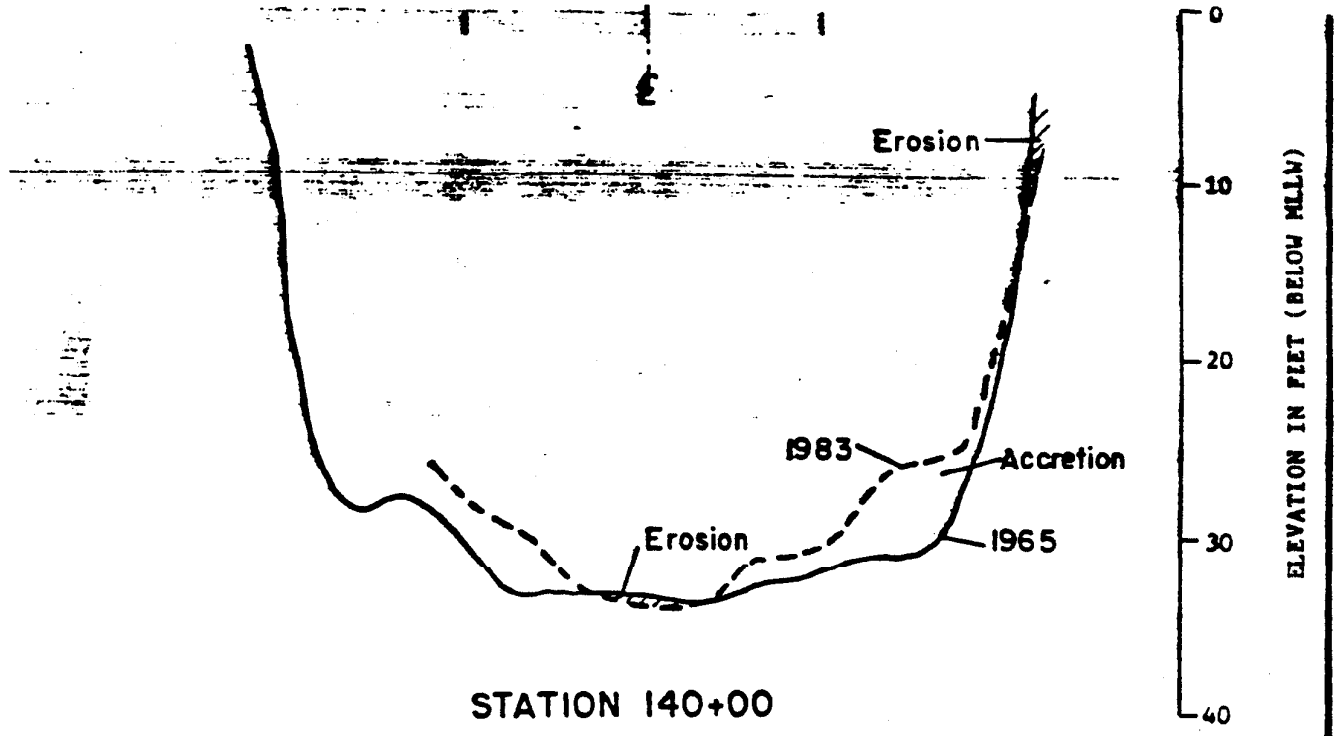


STATION 142+00

HYLEBOS CROSS-SECTIONS, KAISER DITCH, STATIONS 140+00 AND 142+00, YEARS 1972 (POST-DREDGE) AND 1983

LANDAU ASSOCIATES	CROSS-SECTIONS



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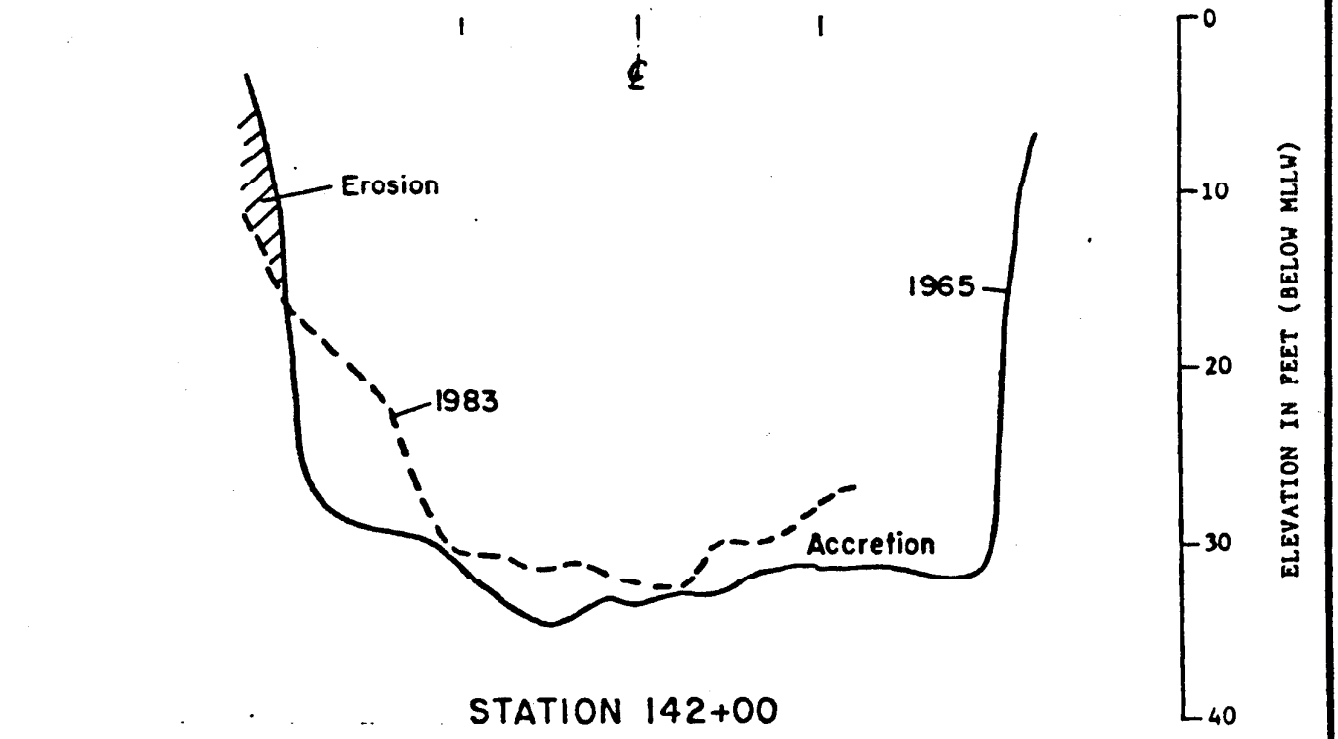
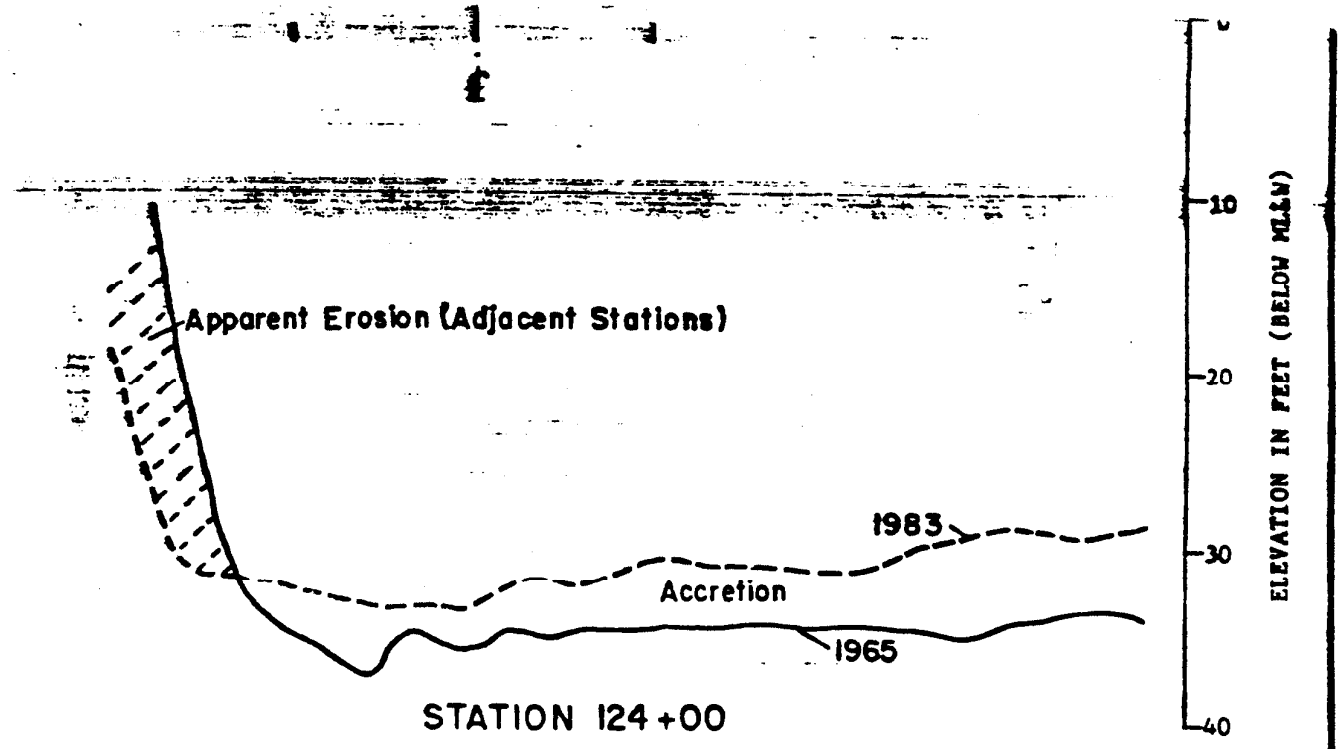


STATION 142+00

HYLEBOS CROSS-SECTIONS, KAISER DITCH, STATIONS 140+00 AND 142+00, YEARS 1965 AND 1983

LANDAU ASSOCIATES	CROSS-SECTIONS

Figure 6



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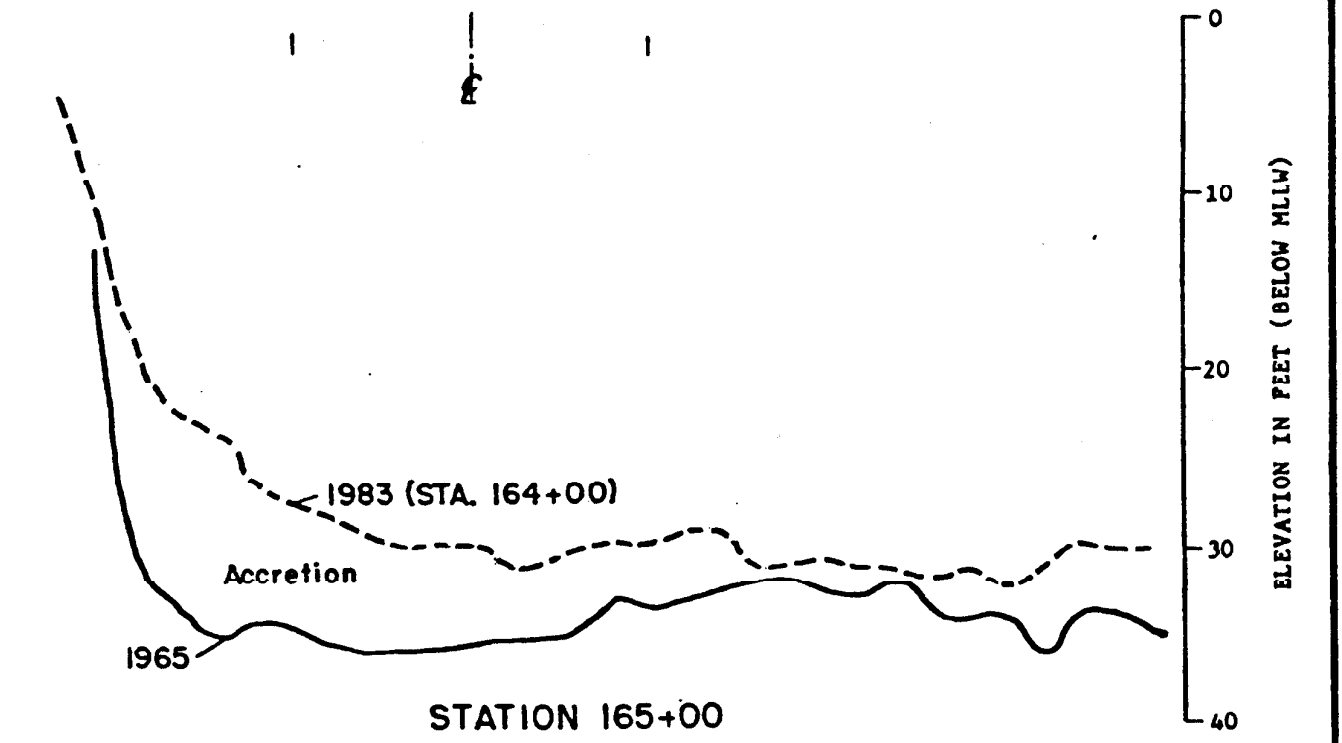
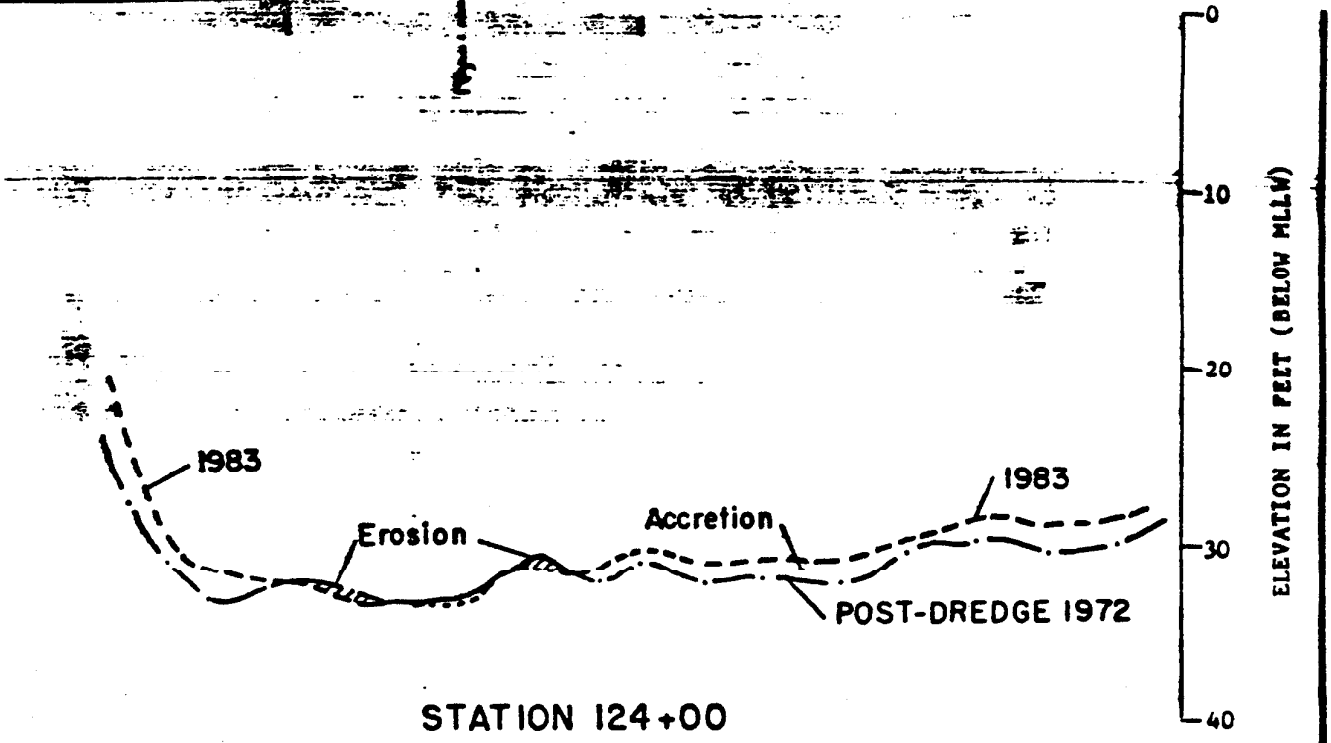


HYLEBOS CROSS-SECTIONS, OUTER AND INNER TURNING BASINS,
STATIONS 124+00 AND 165+00, YEARS 1965 AND 1983

LANDAU ASSOCIATES	CROSS-SECTIONS

Figure 7



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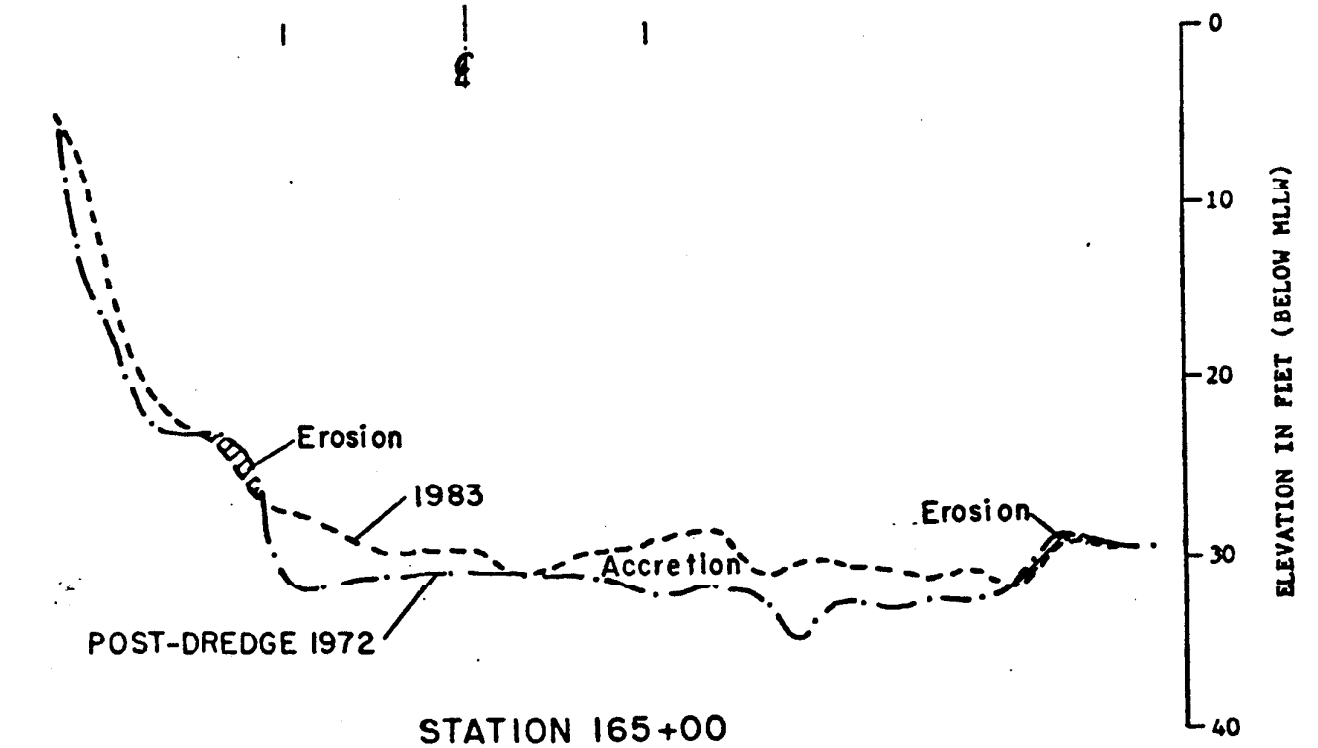
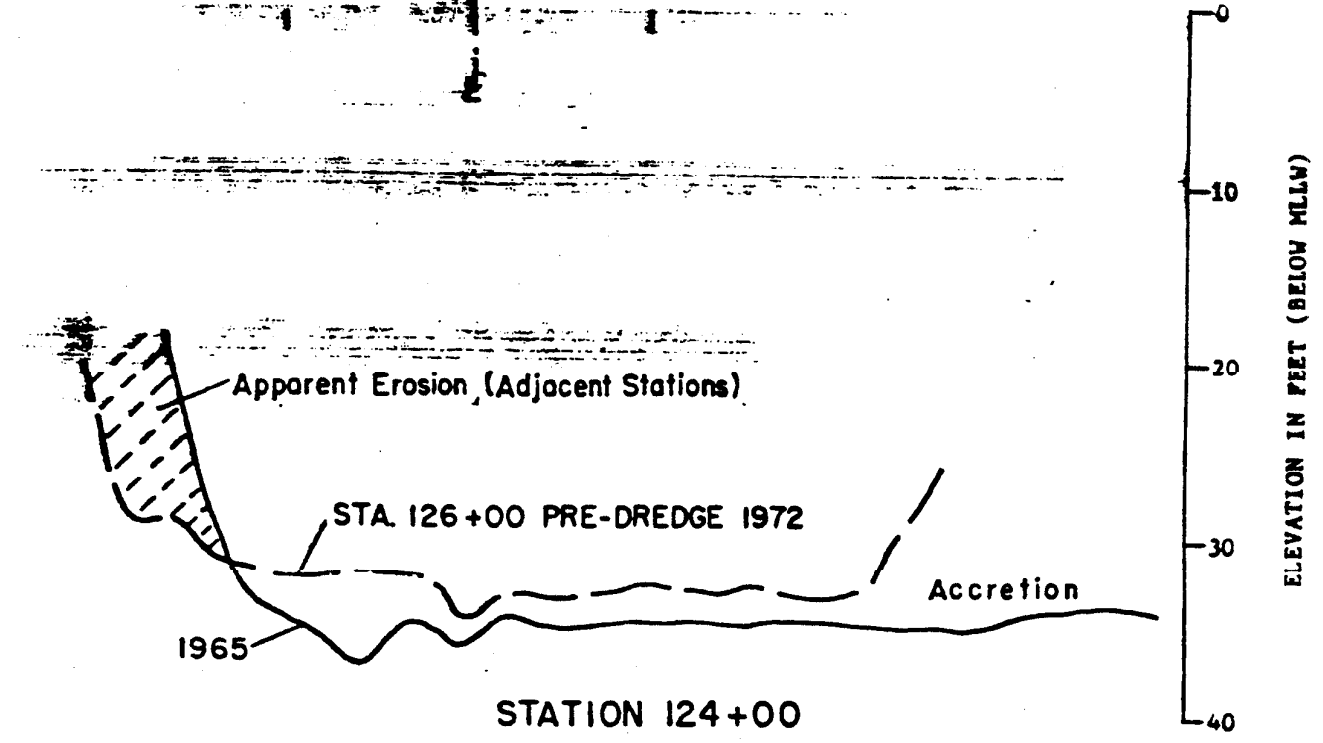


HYLEBOS CROSS-SECTION, OUTER AND INNER TURNING BASINS,
STATIONS 124+00 AND 165+00, YEARS 1972 (POST-DREDGE) AND 1983

LANDAU ASSOCIATES	CROSS-SECTIONS

Figure 8



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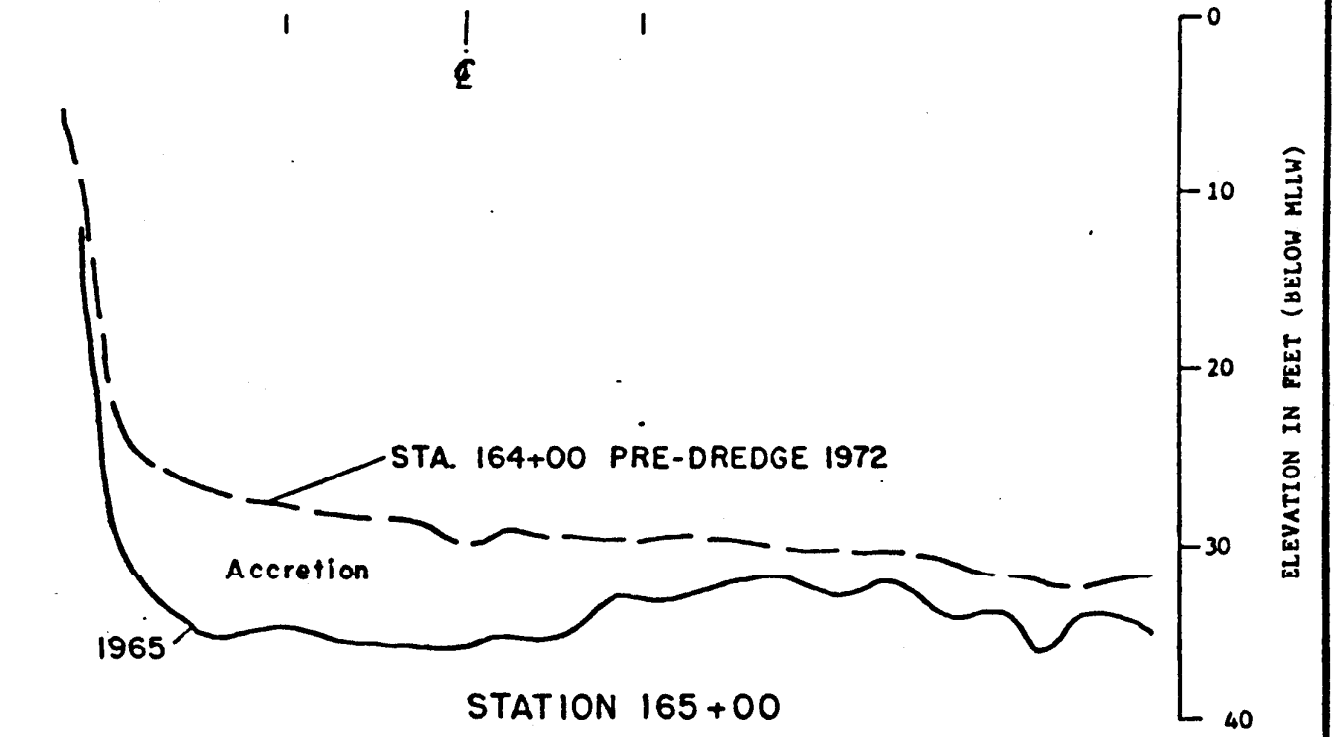


HYLEBOS CROSS-SECTIONS, OUTER AND INNER TURNING BASINS,
STATIONS 124+00 AND 165+00, YEARS 1965 AND 1972 (PRE-DREDGE)

LANDAU ASSOCIATES	CROSS-SECTIONS

dredging) and From 1972 post-dredging to 1983. Figure 4 presents information for the cross-sections at Station 140 and 142 (near the Kaiser ditch) for the period from 1965 to pre-dredging 1972. Figure 5 shows the same cross-section stations from 1972 post-dredging to 1983. Figure 6 shows the same cross-sections for the entire time span from 1965 to 1983. Figures 7, 8, and 9 present similar time sequence information for Station 124, near the outer turning basin and the Morningside ditch, and Station 165, at the inner turning basin where Hylebos creek discharges into the waterway. The patterns identified from a review of these data are presented on Table 1. The most significant conclusions are summarized below.

- During the period from 1965 to 1972 significant accretion occurred along the channel center line.
- During the period from 1965 to 1972 deltas formed opposite the Kaiser ditch discharge, at the mouth of the Hylebos Creek and in the inner turning basin.
- During the period from 1972 to 1983 minor erosion occurred near the outfall of the Kaiser ditch. Some accretion continued near the mouth of Hylebos creek and in the inner turning basin.
- Some accretion is apparently caused by erosion or slumping of the channel slopes into the central portion of the waterway.
- The 1972 maintenance dredging effectively removed accreted sediment from the waterway's central channel,

but left significant amounts of sediment on the side slopes.

- The present sediment thickness in the central portion of the channel near the Kaiser ditch varies from about zero to 1 foot. The sediment is somewhat thicker along the side slopes, although data are not complete for these areas.

PREVIOUS SEDIMENT INVESTIGATIONS

Several studies have examined the chemical and biological characteristics of sediment in the Hylebos Waterway. These include a NOAA-sponsored study by Riley et. al. (1981) and one by Johnson et. al. (1983) (jointly sponsored by EPA and WDOE). NOAA (Riley) reported PAH concentrations in sediment cores taken at 6 sites in the Hylebos Waterway. The cores ranged from 25 to 50 centimeters (cm) in length. For the area between the inner and outer turning basins, the concentrations of total PAH (see Table 2) over the length of the cores ranged from .3 to 28.5 parts per million (ppm). EPA/WDOE (Johnson) reported on 9.0 cm diameter by 2.0-2.5 cm deep cores and Van Veen grab samples taken in the Hylebos Waterway. Total PAH concentrations for the area between the 2 turning basins were reported to range from less than 1 to 407 ppm. Results from NOAA (Riley R2-1, R2-2), EPA/WSDOE (Johnson JHI 1-7, JHS 1-8), and Kaiser sponsored studies (H1-7, K1-7, L1-6) are summarized in Table 2. The locations of the sampling stations are shown on Figure 10. Note that the highest concentration identified during these investigations

Table 2 - Total PAH's in Sediments (in ppm)

SAMPLE	LOCATION	CONCENTRATIONS*
JHS 1	inner turning basin	5.41*
2	inner turning basin	20.24
3	outer turning basin	--
4	opposite turning basin	--
5	Kaiser Ditch discharge	--
6	outer turning basin	--
7	outer turning basin	12.54
8	outer turning basin	6.49
JHI 1	inner turning basin	--
2	Kaiser ditch discharge	406.6*
3	near Pennwalt	1.47
4	near Pennwalt	0.36
5	near Pennwalt	8.09
6	near Pennwalt	40.51
7	near Pennwalt	1.15
R2-1	inner turning basin	4.42**
R2-2	outer turning basin	12.20**
K 1	Kaiser Ditch	<1***
2	Kaiser Ditch	1
3	Kaiser Ditch	80
4	Kaiser Ditch	202
5A	Kaiser Ditch	9
6	Kaiser Ditch-Taylor Way	259
7A	Kaiser Ditch-P.L. 4	298
L 1	Weyco dock near Kaiser Ditch	403*
2	Weyco dock near Kaiser Ditch	39
3	Weyco dock near Kaiser Ditch	162
4	Weyco dock near Kaiser Ditch	221
5	Weyco dock near Kaiser Ditch	66
6	Weyco dock near Kaiser Ditch	135

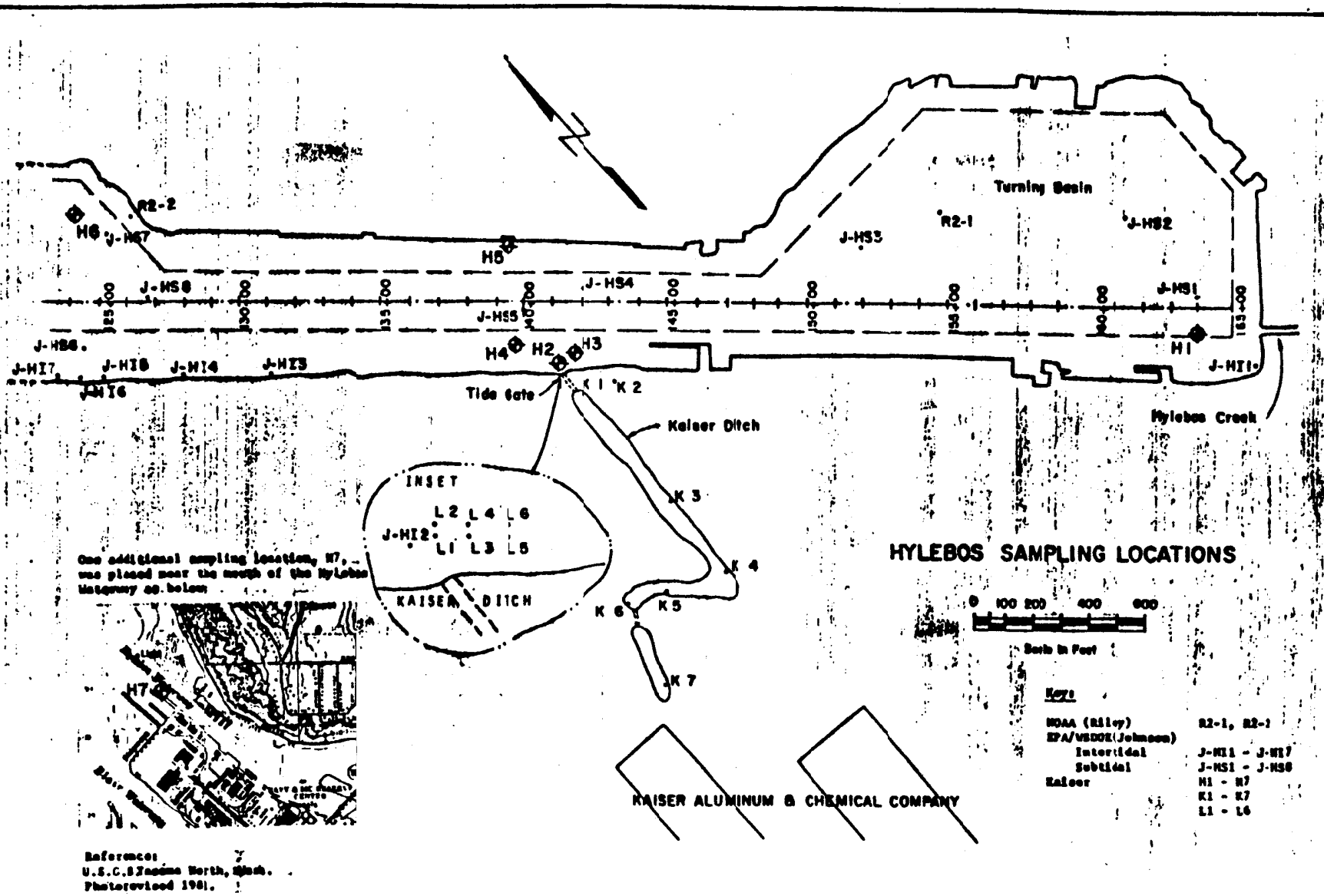
Notes:

A dash indicates not tested, not detected or detected but not quantified.

* PAH concentrations refer to the sum of anthracene, benzo(a)anthracene, benzo(a)pyrene, chrysene, fluoranthene, fluorene, phenanthrene and pyrene.

** Concentrations averaged over length of sediment core, and only refer to the above PAH compounds.

*** Total concentrations for the following PAH's: anthracene, phenanthrene, fluoranthene, pyrene, chrysene, benzo(a)-anthracene, TPh, benzo(a)fluoranthene, benzo(a)pyrene, benzo(e)pyrene, and perylene.



LANDAU ASSOCIATES | PLOT PLAN

Figur

was 407 ppm for an intertidal sample in the immediate vicinity of the Kaiser ditch.

PAH's have been identified in all of the Commencement Bay industrial waterways. For high molecular weight PAH's in the subtidal zone, Sitcum and City Waterways have higher levels than Hylebos. Hylebos Waterway has the highest level for high-molecular-weight PAH's in the intertidal zone. Similarly for low-molecular-weight PAH's, most of the other waterways have higher levels than the Hylebos in the subtidal zone, while the Hylebos Waterway has the highest levels in the intertidal zone (Tetra Tech, 1983B).

Several attempts have been made to to associate PAH's with carcinogenic lesions in marine species. PAH's were not detected in English Sole liver tissues in the Hylebos Waterway during the study by Malins (1980). However, crabs containing elevated PAH concentrations were found in a survey by Malins, et. al. (1983). Data from Swartz, et. al. (1982) showed no significant correlation between amphipod survival and the concentrations of certain PAH's. However, laboratory experiments with benzo(a)pyrene showed dose response rates of sister chromatid exchange in fish liver tissue (Stromberg, et. al., 1981) and Chapman, et. al. (1982) demonstrated a significant correlation between oligocheate respiration and the concentration of pyrene at six sites in the Hylebos Waterway.

The Hylebos Waterway also has very high levels of other contaminants, including aldrin, hexachlorobenzene, hexachlor-

abutadiene, and 4, 4' - DDT. According to Tetra Tech (1983), in comparison to other classes of contaminants, the PAH elevations above background in the Hylebos Waterway are relatively low.

Kaiser Aluminum has accomplished several studies to identify whether Kaiser sludge had escaped from the ponds into the ditch and Hylebos Waterway. The first two studies were performed to provide an indication of PAH levels and to identify whether the fingerprint for the PAH's in the ditch and near the ditch discharge were similar to those for the PAH's in the ponds. Results of the first study, which consisted of 6 samples from the Kaiser ditch, and one sample of dredge material which had apparently been removed from the Hylebos Waterway, were discussed with the Department of Ecology during a meeting on 9 September 1983. The results of that study are summarized in Table 2 (K1-K7). The locations of the sampling points are shown on Figure 10.

Kaiser Aluminum also obtained samples from shallow sediment beneath a Weyerhaeuser floating dock where the dock approaches the Kaiser ditch discharge. These samples were obtained by pushing a PVC pipe into the bottom, withdrawing it and extruding the material into glass jars. Results of this sampling are shown in Table 2 (L1-L6). The sampling locations are shown on Figure 10.

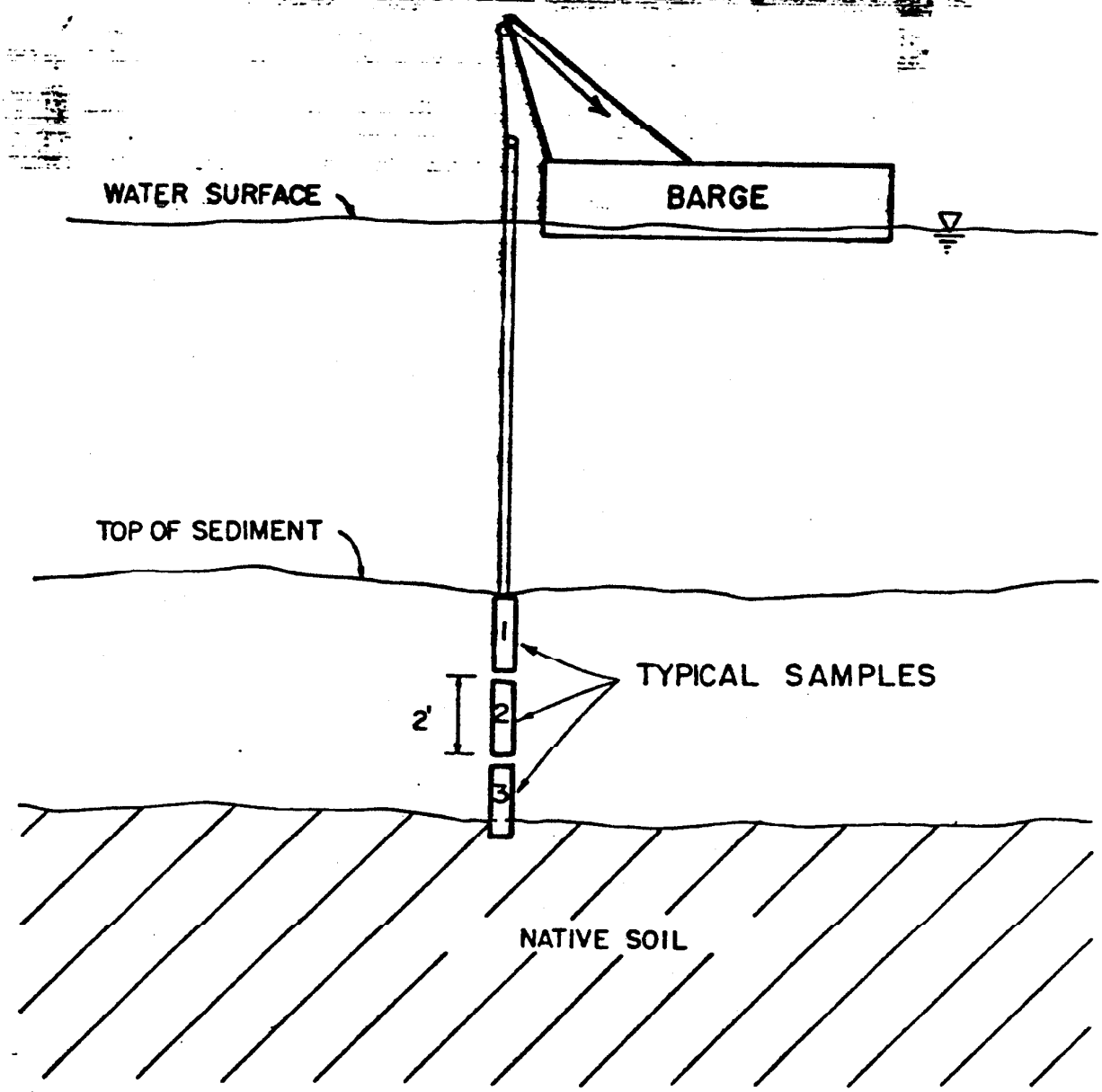
The results of these preliminary studies show conclusively that Kaiser sludge had at some time in the past escaped from Kaiser property into the ditch and the Hylebos

Waterway. The sludge had apparently been diluted with other sediments by a factor ranging from 100 to 50,000. In most cases the sediment fingerprints were very similar to those for the Kaiser sludge.

CURRENT INVESTIGATION

Field Procedures

The purpose of the current investigation was to expand the available information by sampling further from shore and over a wider range of sampling locations than previous Kaiser studies. A program for this study was submitted to the Department of Ecology for their review on 31 October 1983. The program identified 7 high priority sampling sites and 3 sites which would be sampled if time permitted. The 7 locations (H1-H7) actually sampled November 8 and 9, 1983, are shown on Figure 10. Soil samples were obtained using a barge-mounted Osterberg type sampler which could be pushed to any assigned depth below the top of the sediment, activated by compressed air and withdrawn with a sample between 24 and 30 inches long. The samples were then placed in a trough lined with aluminum foil. Representative samples were obtained from both the top half and bottom half of the sampler. Both the top half and the bottom half were then split without homogenization, one sample being sent directly to Kaiser Laboratories and the second being archived. The manner of performing the Osterberg sampling procedure is shown graphically in Figure 11. The field protocol is described in detail in Appendix A.



OSTERBERG SAMPLING PROCEDURE

LANDAU ASSOCIATES	SAMPLING PROCEDURE

The results of the field investigation are summarized in Table 3. This table shows the depth at which samples were obtained, the approximate bottom elevation, the thickness of the sediment above native soil, and a description of both the sediment and the native soil. In general the sediment consisted of black organic silt, while the native soil ranged from sandy silt to clayey silt. The thickness of the sediment ranged from less than 1 foot to almost 4 feet. The thickness of the sediment in the vicinity of the Kaiser outfall ranged from 2 to 4 feet. At location H-2 closest to the Kaiser ditch outfall, the sediment was considerably coarser than at most other locations. This is apparently due to scour from the higher-velocity water discharged from the ditch. Scour would have been especially severe during the period when the tide gate was broken.

Chemical Analyses

The primary purpose of the chemical analyses was to evaluate the quantity of PAH in the sediments and the specific PAH fingerprint. The samples were first air dried, pulverized and screened through a 10 mesh sieve to remove debris, stones and shells. Material which passed through this screen (greater than 98 percent for each sample) was used for further testing. To identify the grain size of the remaining material, an aliquot was washed through a 65 micron mesh with running water. The percent retained on the sieve is indicated in Table 4. The samples were then analyzed with thin layer chromatography analyzing the UV fluorescence.

TABLE 3

KAISER/TACOMA - HYLEBOS WATERWAY
SAMPLING SUMMARY, NOV. 8-9, 1983

Location	Sample Attempt #	Depth Interval Below Bottom	Sample[1] #	Sample Depth	Approx.[2] Bottom Elevation	Approx. Sample Elevation	Depth to Natural Soil	Unified Soil Classification Description	Generalized Soil Description
B 1	1	0 - 2'	B101, B102	0 - 0.5'	-29'	-29.0 to -29.5'	3.0'	OL	Black organic silt
			B103, B104	1.5-2.0'		-30.5 to -31.0'		OL	Black organic silt
	2	2 - 4'	B105, B106	2.5 -3.0'		-31.5 to -32.0'		OL	Black organic silt
			B107, B108	3.5 -4.0'		-32.5 to -33.0'		ML/CL	Gray clayey silt
B 2	1	0 - 2'	B109, B110*	0 -0.5'	-7.8'	- 7.8 to -8.3'	3.6'	SM/PT	Black med. to coarse
			B111, B112	1.5 -2.0'		- 9.3 to -9.8'		SM/PT	Black med. to coarse sand, sl. silty, w/wood
	2	2 - 4'	B113, B114	2.0 -2.5'		-9.8 to -10.3'		SM/PT	Black med. to coarse sand, sl. silty, w/wood
			B115, B116	3.0 -3.5'		-10.8 to -11.3'		SM/PT	Black med. to coarse sand, sl. silty, w/wood
B 3	1	0 - 2'	B117, B118	0 - 0.5'	-19'	-19.0 to -19.5'	≥6.5'	ML/SM	Black sandy silt w/silty sand
			B119, B120	1.5'-2.0'		-20.5 to -21.0'		ML/SM	Black sandy silt w/silty sand
	2	2 - 4'	B121, B122	3.0'-3.5'		-22.0 to -22.5'		ML/OL	Gray clayey silt w/organics
			B123, B124	4.0'-4.5'		-23.0 to -23.5'		ML/OL	Gray clayey silt w/organics
B 4	1	0 - 2'	B125, B126	0 - 0.5'	-25'	-25.0 to -25.5'	≥3.5'	ML/SM	Black sandy silt w/silty sand
			B127, B128	1.5 -2.0'		-26.5 to -27.0'		ML/SM	Black sandy silt w/silty sand
	2	2 - 4'	B129, B130	2.0 -2.5'		-27.0 to -27.5'		ML/SM to ML/OL	Black sandy silt changing to gray clayey silt
			B131, B132	3.5 -3.0'		-27.5 to -28.0'		ML/OL	Gray clayey silt
B 5	1	0 - 2'	B133, B134	0 - 0.5'	-20.5'	-20.5 to -21.0'	0.5'	SM/ML	Black silty sand w/sandy silt
			B135, B136	0.5 -1.0'		-21.0 to -21.5'		SM/ML to ML/PT	Black silty sand changing to gray clayey silt
B 6	1	0 - 2'	B137, B138	0 - 0.5'	-30'	-30.0 to -30.5'	1.0'	ML/SM	Dark gray-black sandy silt w/silty sand
			B139, B140	0.5 -1.0'		-30.5 to -31.0'		ML/SM	Dark grey-black sandy silt w/silty sand
B 7	1	0 - 2'	B141, B142	0 - 0.5'	-33'	-33.0 to -33.5'	3.0'	ML/SM	Black sandy silt w/sand, shells
			B143, B144	1.5 -2.0'		-34.5 to -35.0'		ML/SM	Black sandy silt w/sand, shells
	2	2 - 4'	B145, B146	2.0 -2.5'		-35.0 to -35.5'		ML/SM	Black sandy silt w/sand, shells
			B147, B148	3.5 -3.0'		-35.5 to 36.0'		ML/SM	Black sandy silt w/sand, shells

1 Odd-numbered samples analysed by Kaiser CPT Lab. Even-numbered samples are duplicates frozen and stored.
2 Approximate bottom elevations calculated in field using depth soundings and tide tables.
* Additional duplicate sample supplied to Washington State Department of Ecology.

TABLE 4

PAH Analytical Results

Sample Location	Sample Depth	Sample No.	Size >65u, %	PAH Concentration[1], ppm Measured by GC	Estimated from TLC
H-1	0-0.5'	101	30		<3
Inner	1.5-2'	103	30	3	
Turning	2.5-3'	105	50		<2
Basin	3.5-4'	107	10		<2
H-2	0-0.5'	109	80	33	
Kaiser	1.5-2'	111	80	108	
Ditch	2-2.5'	113	85		<20
Discharge	3-3.5'	115	85		<5
H-3	0-0.5'	117	65		<30
Kaiser	1.5-2'	119	70	31	
Ditch	3-3.5'	121	60		>500*
Discharge	4-4.5'	123	10		>500*
H-4	0 0.5'	125	55	16	
Kaiser	1.5-2'	127	55		>500*
Ditch	2-2.5'	129	10		>500*
Discharge	2.5-3'	131	15		>800*
H-5	0-0.5'	133	70		<20
Opposite Ditch	0.5-1'	135	70		<10
H-6	0-0.5'	137	35		<10
Outer Turning Basin	0.5-1'	139	70	14	
H-7	0-0.5'	141	50		<10
Waterway	1.5-2'	143	60	45	
Mouth	2-2.5'	145	65		<30
	2.5-3'	147	60		<10

* Typical "Kaiser Sludge" by TLC
1 Based on dry weight of solids.

Based on the fluorescence response, the variation of PAH levels with depth was established at each sampling location. Seven samples were then analyzed using gas chromatography (Hanneman, 1984).

The results of the chemical analysis are summarized in Table 2. Measurable quantities of PAH's were found at all sampling locations. Except for the three sampling locations closest to the Kaiser ditch, measured PAH concentrations were all less than 100 parts per million. At location H-2, closest to the ditch discharge the sample at a depth of 1.5 feet had a concentration of 108 parts per million, while all the other samples at location H-2 had concentrations less than 50 parts per million. At locations H-3 and H-4, located about 80 feet and 170 feet respectively from the Kaiser ditch discharge, the concentrations of the shallow samples were all less than 50 parts per million, while the concentrations below depths of about 1.5 feet exceeded 500 parts per million. For the 5 samples at the 2 locations where the concentrations exceeded 500 parts per million, the PAH "fingerprint" agreed with that for typical Kaiser sludge as determined from previous chemical testing.

CONCLUSIONS AND RECOMMENDATIONS

The results of this and previous investigations support the following conclusions:

- Prior to 1972, accretion was common in the Hylebos Waterway. In several areas, including both turning basins and the area adjacent to the Kaiser ditch, deltas formed. The average thickness of the sediment in the vicinity of the Kaiser ditch as derived from Corps of Engineers dredging records was 5.7 feet.
- Maintenance dredging of the Hylebos Waterway in 1972 was effective in removing sediment in the central portion of the channel, but left sediment on the slopes.
- After 1972 the amount of sedimentation in the Hylebos Waterway decreased significantly. In the area near the Kaiser ditch, erosion occurred. This may be due, in part, to failure of the tide gate at the ditch discharge, which would result in higher flow rates and higher flow velocities which could cause scour.
- The measured thicknesses of sediment in the vicinity of the Kaiser ditch ranged from about 1 to 4.5 feet. In general the thicknesses of the sediment measured in the field were less than or equal to the thicknesses previously identified from a review of the Corps of Engineers dredging surveys.
- The results of previous investigations and this investigation identified low concentrations of PAH in

the shallow sediments in the waterway consistant with background concentrations in other Commencement Bay waterways.

- Chemical testing performed in this study showed that the PAH fingerprints in the near surface sediments are different from the Kaiser sludge "fingerprint".
- Chemical analysis for sediment in the depth range close to the sludge/natural soil contact zone at two (H3 and H4) of the three locations near the Kaiser ditch shows the same "fingerprint" as that for the Kaiser sludge. The PAH concentrations in these deeper sediments are in the range of 500 ppm to 1500 ppm.
- Based on plant records of wet scrubber operations and maintenance of settling ponds, the deposits of PAH's in the Hylebos Waterway in the vicinity of the Kaiser ditch are probably the result of hydraulic dredging of the sludge ponds in 1969 and 1971.
- A rough estimate of the quantity of sludge-contaminated sediment in the Hylebos Waterway can be made on the basis of the available physical and chemical results. Kaiser sludge was identified at sampling locations H-3 and H-4, but not at H-5. Assuming that a delta formed at the ditch discharge, the radius of the delta was probably less than about 470 feet (the distance to H-5). Dredging of the central waterway in 1972 and subsequent scouring probably removed the sludge from that area. Assuming

that sludge is present in the waterway between mean low water and the central channel (a width of 140 feet) and over a length equal to twice the delta radius (940 feet) and assuming a thickness of 1.5 feet based on the results at locations H-2 and H-3, the calculated quantity is 7300 cubic yards.

- There is no evidence of contemporary deposition of PAH's from the Tacoma works as evidenced by the absence of PAH's in the upper sediment in concentrations above background levels found elsewhere in Commencement Bay and because the PAH's in the upper sediment do not exhibit a chemical "fingerprint" consistant with the Kaiser wet scrubber sludge.
- Reconstruction of the tide gate and construction of a silt curtain should eliminate or significantly mitigate the future release of suspended sediment to the Hylebos Waterway.
- Since the PAH contaminated sediments are buried under more recent deposits and are below the biologically active zone, they may safely be left in place until the waterway is next dredged.
- Further effort to quantify or define the lateral distribution of sludge-contaminated sediments should be deferred until it is determined whether remedial action is necessary and the cleanup criteria are better defined. Such criteria are necessary to define sampling and testing proccdurcs.

. Future maintenance dredging of the Hylebos Waterway should address the proper disposal of PAH contaminated sediment obtained in the vicinity of the Kaiser ditch discharge.

Respectfully submitted,

LANDAU ASSOCIATES

By:

Henry G. Landau, Ph.D., P.E.

HGL/sg
15 February 1984

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APPENDIX A

Field Explorations and Sample Handling

General

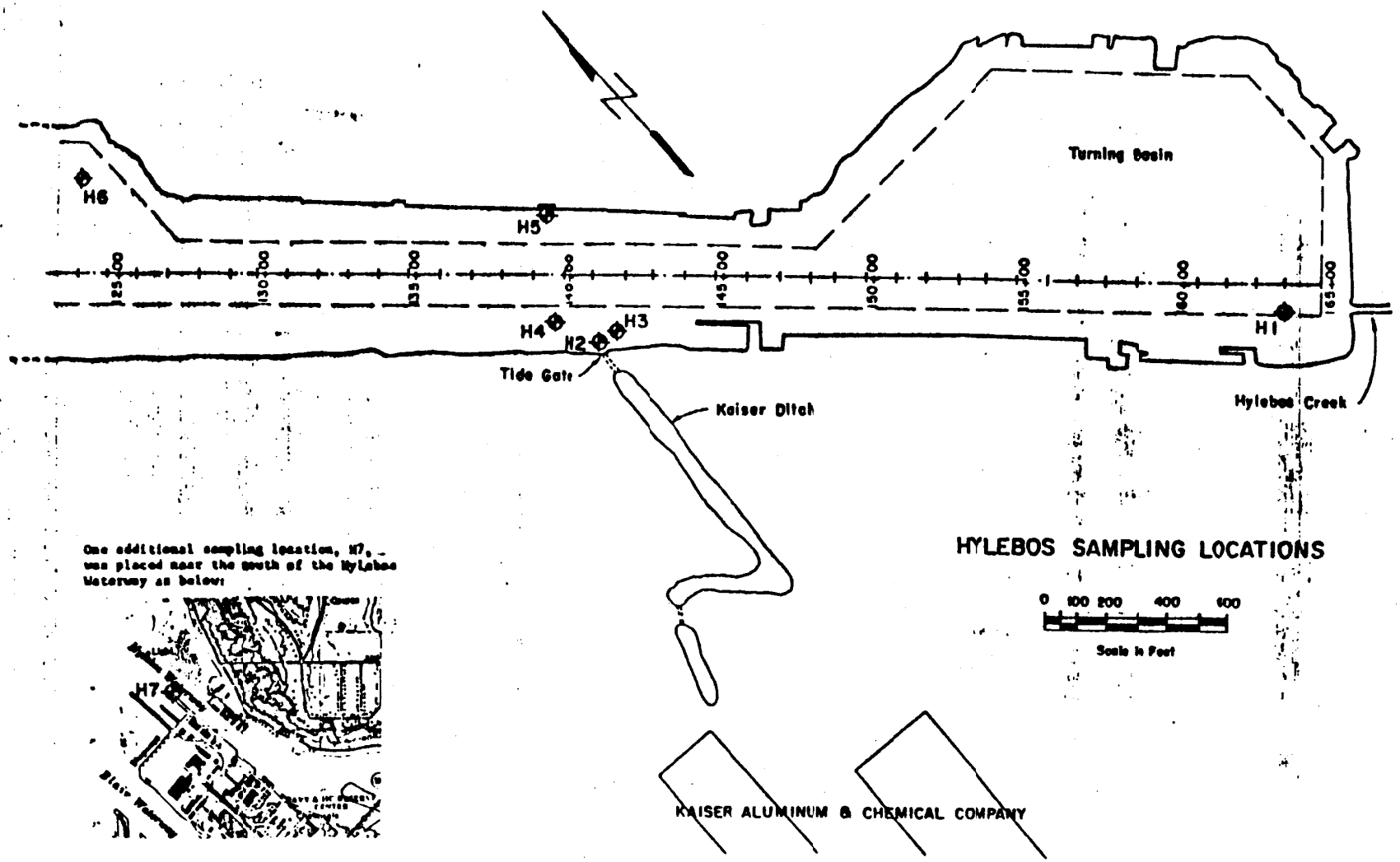
The field explorations consisted of navigating a self-propelled barge to a total of 7 general sampling positions in the upper Hylebos Waterway, determining the barge position and bottom elevations at each of the sampling locations, and pushing an Osterberg piston sampler into the bottom sediments. Sediment samples were extruded, described, visually classified, and divided into portions for analysis and duplicates for storage.

Bathymetry

Water depths were measured manually to the nearest 0.1 foot at each sampling location. The time of day was noted for each depth measurement. Positioning of the barge was accomplished using a compass to obtain horizontal angles and bearings from North to reference landmarks on shore. Depths of sediment samples were referenced to bottom depth soundings and to measurements taken along the drill rods used to lower the Osterberg sampler from the barge.

Sample Locations

See attached map (Figure A-1).



LANDAU ASSOCIATES	PLOT PLAN

Figure A

Sampling Procedure

Sediment sample cores were obtained with an Osterberg piston sampler, lowered vertically to the waterway bottom by winch and attachmented to the end of a string of steel drill rods. It was determined in the field that the weight of the rods could advance the sampler to the desired sampling depths, due to the relatively soft consistency of the bottom sediments. Successive sample cores were taken at approximately 2 foot increments at each general sampling position. The desired sampling depths were established using markings on the drill rods and frequent water depth soundings to account for the changing tide.

Once the tip of the sampler tube was established at the desired sampling depth, the stainless steel thin wall sampling core tube was pushed 24 inches into the sediment by activating the sampling piston with a charge of compressed air. The sediment was manually extruded from the sampling tube into a polyethylene trough lined with heavy-duty aluminum foil. The foil was discarded after each sample extrusion and replaced with fresh foil. The polyethylene trough was washed and rinsed three times in sea water between uses. The stainless-steel sampling tube was cleaned with a scrub brush and then triple rinsed with sea water.

Sample Handling

After extruding each sample, the sediment was examined visually, its characteristics recorded on standard boring

logs (summarized on Figure 2, sample summary), and classified according to the Unified Soil Classification System (Figure 3). Based upon visual examination of each sample, representative portions of the upper and lower parts of the sample were selected for laboratory testing. Each of these portions was split into halves without homogenizing the sub-sample; one half was designated for immediate testing and the other for storage and possible future testing. After sample selection and sub-sample splitting, each part was immediately transferred to a new 8 oz. glass jar and sealed with aluminum foil under a screw cap.

Samples were logged according to the location and depth at which they were taken and whether they were intended for immediate testing or storage. A simplified numerical designation was used for laboratory purposes. For example:

sample H2 - 1TK = H 201 (odd # reserved for immediate testing, even # for duplicates)

where H = Hylebos Waterway
2 = Location #2
1 = The uppermost sample at that location
T = Top of Osterberg tube (B = bottom)
K = Sample to be sent to Kaiser CFT
(D = duplicate sample)

The samples were kept on ice and custody was transferred to Kaiser at the end of each working day. A chain of custody control form (attached) was maintained on each day's lot of samples. The K samples were delivered by Kaiser to its analytical laboratory within 72 hours of obtaining the samples. The D samples were frozen and stored at Kaiser's Tacoma facility.

Discussion

Sediment thicknesses in the Hylebos Waterway were found to be generally slightly less than anticipated. As a result, the depths at which samples were obtained were adjusted to provide a more complete assessment of the sediment column above natural soil. At 3 sampling positions, samples of the natural soil were obtained in the second sample attempt: these were retained at the discretion of the field engineer.

The sediment collected during the initial sampling attempt at the second sample at location H3 apparently fell out of the sampler during retrieval. Soundings made after the attempt revealed a detectable crater in the waterway bottom, probably created by compressed air release or by impact of fallen core. The barge location was repositioned the following day approximately 3 feet seaward to resample the second depth. Because the bottom depth at the new position was about one foot deeper, the sample depth was set at 3 feet relative to the initial sampling location, in order to avoid resampling the same material found in the first sample attempt. Thus, the second attempt at location H3 was recorded as 3 to 5 feet. Even with these precautions, it would have been impossible to ensure against any mechanical disturbance of the sediments being sampled.

The results of the chemical testing indicate that, at locations H-3 and H-4, what we identified as natural soil in the field was probably the lowermost portion of the sediment column. Some mechanical mixing is believed to have occurred during sampling due to the repeated sampling attempts at H-3.

Additionally, the initial deposition of sediment in the newly dredged waterway in the mid-1960's is likely to have resulted in some mixing of new sediment with older soft natural soils.

APPENDIX A

CHAIN OF CUSTODY RECORD

FOR: KAISER ALUMINUM + CHEM. CO.

DATE: 8 NOV 83

LOCATION: TACOMA — HYLEBOS WATERWAY

DESCRIPTION OF SAMPLES: 10 8-oz glass jars. Labelled H101, H103, H105, H107, H109, H111, H113, H115, H...

PURPOSE OF SAMPLING: SEDIMENT IN WATERWAY NEAR KAISER DITCH

CONSULTANT: LANDAU ASSOC.

CONTRACTOR: KRING DRILLING

NUMBER OF SAMPLES: 10

SAMPLE DESIGNATIONS: see description above / TK + BK for analysis

RELINQUISHED BY (SIGNATURE)	DATE / TIME	RECEIVED BY (SIGNATURE)	REASON FOR CHANGE OF CUSTODY
David B. Smith	8 Nov 83 / 1700 WA	James E. Gray	Kaiser
RELINQUISHED BY (SIGNATURE)	DATE / TIME	RECEIVED BY (SIGNATURE)	REASON FOR CHANGE OF CUSTODY
James E. Gray	10 Nov 83 / 0845 AM	Emery Air	Shipment
RELINQUISHED BY (SIGNATURE)	DATE / TIME	RECEIVED BY (SIGNATURE)	REASON FOR CHANGE OF CUSTODY
	11/11/83 2:35 pm	Lynn Kight	

SUMMARY OF RESULTS (ATTACHMENTS AS REQUIRED):

REMARKS:

CHAIN OF CUSTODY RECORD

FOR: Kaiser A. & C. Corp. / Tacoma

DATE: 9 Nov 83

LOCATION: Hylebos Waterway

DESCRIPTION OF SAMPLES: 8-oz glass jars (K-- for analysis by Kaiser CFT)

PURPOSE OF SAMPLING: Sediments in waterway

CONSULTANT: Landau Associates

CONTRACTOR: Kring Drilling

NUMBER OF SAMPLES: 14

SAMPLE DESIGNATIONS: H121, [redacted] H123, H125, H127, H129, H131, H133, H135, H137, H139, H141, H143, H145, H147

RELINQUISHED BY (SIGNATURE)	DATE / TIME	RECEIVED BY (SIGNATURE)	REASON FOR CHANGE OF CUSTODY
[illegible] B. Palmiter for Landau	9 Nov 83/1634	James E. Gruy	Kaiser
RELINQUISHED BY (SIGNATURE)	DATE / TIME	RECEIVED BY (SIGNATURE)	REASON FOR CHANGE OF CUSTODY
James E. Gruy	10 Nov 83/0845 AM	Emery	Shipment
RELINQUISHED BY (SIGNATURE)	DATE / TIME	RECEIVED BY (SIGNATURE)	REASON FOR CHANGE OF CUSTODY
	11/11/83 2:35 pm	Lyn Eglitis	

SUMMARY OF RESULTS (ATTACHMENTS AS REQUIRED):

REMARKS:

APPENDIX B

RAPID TLC SCREENING TECHNIQUE FOR PAH IN SOIL/SEDIMENTS

Lab Procedure - Dry Soil

1. Weigh 1 gm soil dried at room temperature on a weighing paper.
2. Transfer soil sample into stoppered 4 dr. vial.
3. Add 5.0 ml of 1,1,2-Trichlorotrifluoroethane (TCTFE).
4. Mix well, for 1 min., on a Bromwill mixer. Let stand for 10 min.
5. Filter sample solution thru a Pasteur disposable pipet filled with 1/4" glass wool (silane treated) followed by 1/2" florisil and 1/4" Na_2SO_4.
6. Collect filtered solution in a clean, stoppered 4 dr vial for TLC screening.
7. Prepare Reference sample (STD) by applying above procedure to soil sample containing 300 ppm PNA.

TLC

1. Clean standard TLC chamber.
2. Fill chamber with 100 ml of 90% hexane, 5% TCTFE and 5% Ethylacetate.
3. Apply sample solutions on 10 x 10 HPTLC, RP-18, F-254 (EM Merk). Applied volume = 6 microliter. Development time - approximately 6 minutes.

Field Procedure -Wet Soil

1. Weigh 2 gm wet soil.
2. Add 5 ml TCTFE.
3. Shake well.
4. Apply 6-10 microliter on TLC plate.

Detection:

Use 3600Å for fluorescence detection.

Use 2540Å for quenching detection.

APPENDIX C
GAS CHROMATOGRAPHIC DETERMINATION OF PAH IN SEDIMENTS/SOILS

Procedure

1. Weigh 5 gm of soil dried at room temperature on weighing paper.

2. Transfer soil sample into 8 dr stoppered vial.

3. Add 20 ml of 1,1,2-Trichlorotrifluoroethane (TCTFE). Use ultrasonic at 60°C and Bromwill mixer to extract PNA. Centrifuge and decant solution into 100 ml beaker.

4. Repeat Step #3 twice more. Combine the three extracted solutions.

5. Filter loose particles thru glasswool into 250 ml round bottom flask.

6. Evaporate solvent using Snyder (3 plates) distillation column.

7. Redissolve residue in 5-10 ml Pet ether.

8. Prepare disposable silica gel column by filling half of 5 cc polypropylene reservoir (syringe) with activated silica gel (BiosilA 200-325 mesh at 120°C for 1 hour) topped with Na_2SO_4. Filling column with silica gel should be prepared by slurrying silica gel with Pet ether.

9. Transfer pet ether solution from step 7. onto the prepared column.

10. Pass 30 ml of Pet ether thru the column and discard the liquid.

11. Pass 20 ml of Benzene (PAH fraction) thru the column and collect it in an aluminum weighing dish.

12. Allow benzene to evaporate to dryness in the hood at room temperature.

13. Redissolve PAH fraction in 5.0 ml TCTFE. Solution is ready for GC analysis.

GC Analysis:

Two options.

1st

Packed column GC analysis.

Instrument: PE 3920 Duel FID.

Carrier: Helium at 65 psig.

Temperature: Injector 290°C; Detector 310°C

Program 180°C for two min.
180°C to 290°C
at 32°C/min.
290°C hold to end of analysis

Column: 5' x 1/8" ss filled with 3% Dexsil 300 GC on chromosorb W-HP 80-100 mesh.

Injection: 2.0 microliter at 20X sensitivity.

2nd

Capillary column GC analysis - split/splitless mode.

Instrument: PE Sigma 2B

Carrier: Hydrogen at 14 psig.

Column: 15 meter, DB-5

Temperature: Injector 295°C
Detector 310°C

Program:

50°C isothermally for 2 minutes, thereafter program at 35°C/minute to 150°C. Hold at 150°C for 0.5 minutes and continue at 10°C/min. to 290°C to end of analysis.

Calculations:

Numerical valves are obtained by relating the detector response of the sample to that of a standard after taking into account the relative response factors of the individual PAH components.